Sample Syllabus

ME 300 Engineering Thermodynamics
Spring 2019


PRE-REQUISITES/CO-REQUISITES: CHEM 110 and MATH 141

INSTRUCTOR: Dr. Amrita Basak
Assistant Professor of Mechanical Engineering
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Office: 233 Reber  Phone: 814.865.0043

TEACHING ASSISTANT: Alex Rusted (ajr545@psu.edu)

OFFICE HOURS:
Basak office hours: Mondays 2:30 – 3:30 PM, Reber 233. Outside the office hours, please email me in advance (at least 24 hrs) for an appointment.
TA office hours: Thursdays 2 – 4 PM, Reber 337. Outside the office hours, please email me in advance (at least 24 hrs) for an appointment.

COURSE DESCRIPTION:
Engineering Thermodynamics I. Basic thermodynamics concepts, properties of pure substances, first and second law analysis of systems and control volumes.

GRADING:
Homeworks (12, drop the lowest 1): 25%
Quizzes (6, drop the lowest 1): 20%
Exam 1: 15%
Exam 2: 15%
Final Exam: 25%
Late drops prior to first exam: -WN
Late drops after first exam:
  With a score ≥ 60%: -WP
  With a score < 60%: -WF

GRADING SCALE
A 93
A- 90
B+ 87
B 83
B- 80
C+ 77
C 70
D 60

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CONTESTING GRADES: If you have an issue with your assignment grade, please provide a formal application for grade change. Your application should include a copy of the question and your original answer, and a paragraph explaining why you believe you deserve a grade change. These applications should be emailed to me and the TA within 5 business days after the assignment was returned; verbal requests for grade change will not be considered. If there was an obvious mistake in grading, the TA and I will immediately correct the issue. If the grade change is more subjective in nature, I will file your request and reconsider at the end of the semester if a change in this grade could change your final grade in the class.

MISSED EXAMS/QUIZZES: No make-up exams or quizzes will be given except as required by University policy. See me prior to any anticipated absence, preferably at the beginning of the semester.

ACADEMIC DISHONESTY: Academic dishonesty will not be tolerated at all. I hope that everyone can develop enough pride in his or her own work and abilities that this will never be a problem. When you earn an Engineering degree from Penn State, the University is certifying that you can perform engineering duties at a professional level. Course grades are the sole basis on which the College of Engineering certifies your degree with the assumption that your course grades are a valid assessment of your own knowledge and abilities. If you have cheated, you have falsified that credential. Therefore, we must have academic integrity expectations to ensure the validity of your grade and your degree. It is encouraged, however, to discuss problems solving techniques with classmates in study groups and during office hours. Evidence of academic dishonesty will be dealt with by University Policy 49-20, described at http://www.psu.edu/ufs/policies/47-00.html#49-20. Unauthorized use of a solutions manual is a deliberately dishonest act. For additional University & College policies on academic integrity see http://www.psu.edu/ufs/policies and http://www.engr.psu.edu/CurrentStudents/acadinteg.asp. Using someone else’s phone/computer/alias for in-class assignments is academically dishonest, as is answering questions when you are not in class – only register answers using your own device in the class.

CLASSROOM RULES: Please respect the following classroom rules:
- Please remember to turn your phone ringer off before class starts. Cell phone rings will result in a letter-grade deduction on the final exam.
- Please be in class on time. If you are late, be considerate of your classmates as you enter the classroom and find a seat.
- You will not be given extra time on a quiz or test if you are late.

PROBLEM FORMAT (homework, quizzes, exams):
All homework should be in the following format, unless it is an open-ended question, or trivial.

\textbf{GIVEN}: Include a sketch if possible.

\textbf{ASSUMPTIONS}: These need to be justified if they are atypical.

\textbf{PROBLEM STATEMENT}: What is unknown that we are asked to find.

\textbf{SOLUTION}: Solve the problem, step-by-step, and always include units. \textbf{Box the final answer}.

\textbf{SANITY CHECK}: Miscalculations can lead to unrealistic results. Indicate if you feel that your answer is not realistic!

Note: Your solution method needs to be coherent and systematic. One of the major tools you should leave this course with is enhanced engineering problem solving methodology. Also, please turn in neat assignments – no torn pages, coffee stains, or smudges. If we can’t read it, we won’t grade it.
# Anticipated Class Lecture Schedule

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Date</th>
<th>Topic</th>
<th>Reading Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan 7</td>
<td>Welcome to ME 300</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Jan 9</td>
<td>Basic mathematics</td>
<td></td>
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<tr>
<td>3</td>
<td>Jan 11</td>
<td>Units, unit conversion, pressure, and temperature</td>
<td><a href="#">HW # 1 Posted</a></td>
</tr>
<tr>
<td>4</td>
<td>Jan 14</td>
<td>System, surroundings, and properties</td>
<td></td>
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<tr>
<td>5</td>
<td>Jan 16</td>
<td>Property, equation of state, ideal gas law</td>
<td></td>
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<tr>
<td>6</td>
<td>Jan 18</td>
<td>Energy, work, and zeroth-law of thermodynamics</td>
<td><a href="#">HW # 1 Due, HW # 2 Posted, HW # 1 Soln Posted</a> (EOD)</td>
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<tr>
<td></td>
<td>Jan 21</td>
<td>NO CLASS – MLK DAY</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Jan 23</td>
<td>First law of thermodynamics</td>
<td><a href="#">QUIZ # 1</a></td>
</tr>
<tr>
<td>8</td>
<td>Jan 25</td>
<td>First law of thermodynamics – constant pressure and constant</td>
<td><a href="#">HW # 2 Due, HW # 3 Posted, HW # 2 Soln Posted</a> (EOD)</td>
</tr>
<tr>
<td>9</td>
<td>Jan 28</td>
<td>First law of thermodynamics – constant temperature systems,</td>
<td><a href="#">HW # 4 Due, HW # 5 Posted, HW # 4 Soln Posted</a> (EOD)</td>
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<tr>
<td>10</td>
<td>Jan 30</td>
<td>Thermodynamic properties of fluids</td>
<td></td>
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<tr>
<td>11</td>
<td>Feb 1</td>
<td>Van der Waals equation and compressibility chart</td>
<td><a href="#">HW # 3 Due, HW # 4 Posted, HW # 3 Soln Posted</a> (EOD)</td>
</tr>
<tr>
<td>12</td>
<td>Feb 4</td>
<td>Phase change process of pure substance – T-v and P-T diagrams</td>
<td></td>
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<tr>
<td>13</td>
<td>Feb 6</td>
<td>Phase change process of pure substance – P-v diagram and steam table</td>
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<tr>
<td>14</td>
<td>Feb 8</td>
<td>First law of thermodynamics for a continuous system</td>
<td><a href="#">HW # 4 Due, HW # 5 Posted, HW # 4 Soln Posted</a> (EOD)</td>
</tr>
<tr>
<td>15</td>
<td>Feb 11</td>
<td>Steady state flow processes</td>
<td><a href="#">QUIZ # 2</a></td>
</tr>
<tr>
<td>16</td>
<td>Feb 13</td>
<td>Throttling process and transient flow process</td>
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<tr>
<td></td>
<td>Feb 15</td>
<td>Review Exam 1 (Lectures 1 – 13)</td>
<td><a href="#">HW # 5 Due, HW # 6 Posted, HW # 5 Soln Posted</a> (EOD)</td>
</tr>
<tr>
<td>17</td>
<td>Feb 20</td>
<td>Limitations of the first law of thermodynamics, heat engine, and</td>
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<tr>
<td>18</td>
<td>Feb 22</td>
<td>Introduction to the second law of thermodynamics</td>
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<tr>
<td>19</td>
<td>Feb 25</td>
<td>Carnot cycle</td>
<td><a href="#">QUIZ # 3</a></td>
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<tr>
<td>20</td>
<td>Feb 27</td>
<td>Carnot cycle and Carnot's Principles (Theorems)</td>
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<tr>
<td>21</td>
<td>Mar 1</td>
<td>Carnot's Principles (Theorems) and thermodynamic temperature</td>
<td><a href="#">HW # 6 Due, HW # 7 Posted, HW # 6 Soln Posted</a> (EOD)</td>
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<tr>
<td></td>
<td>Mar 3-9</td>
<td>NO CLASS – SPRING BREAK</td>
<td></td>
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<tr>
<td>22</td>
<td>Mar 11</td>
<td>Reversible cycles</td>
<td><a href="#">QUIZ # 4</a></td>
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<tr>
<td>23</td>
<td>Mar 13</td>
<td>Clausius inequality and introduction to entropy</td>
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<tr>
<td>24</td>
<td>Mar 15</td>
<td>Calculation of entropy change</td>
<td><a href="#">HW # 7 Due, HW # 8 Posted, HW # 7 Soln Posted</a> (EOD)</td>
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<tr>
<td>25</td>
<td>Mar 18</td>
<td>Temperature entropy diagram and second law analysis of a control</td>
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<tr>
<td>26</td>
<td>Mar 20</td>
<td>Available energy and irreversibility</td>
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<tr>
<td>27</td>
<td>Mar 22</td>
<td>Availability function and irreversibility</td>
<td><a href="#">HW # 8 Due, HW # 9 Posted, HW # 8 Soln Posted</a> (EOD)</td>
</tr>
<tr>
<td>28</td>
<td>Mar 25</td>
<td>Power and refrigeration cycles</td>
<td><a href="#">QUIZ # 5</a></td>
</tr>
<tr>
<td>29</td>
<td>Mar 27</td>
<td>Power and refrigeration cycles</td>
<td></td>
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</tbody>
</table>
| Revision 2 | Mar 29 | Exam 2 review  
| HW # 9 Due, HW # 10 Posted, HW # 9 Soln Posted (EOD) |
| Exam 2 | Apr 1 | Midterm 2 (Lectures 14 – 27) |
| 30 | Apr 3 | Power and refrigeration cycles |
| 31 | Apr 5 | Gas power cycles  
| HW # 10 Due, HW # 11 Posted, HW # 10 Soln Posted (EOD) |
| 32 | Apr 8 | Gas power cycles |
| 33 | Apr 10 | Gas power cycles |
| 34 | Apr 12 | Refrigeration cycle  
| HW # 10 Due, HW # 11 Posted, HW # 10 Soln Posted (EOD) |
| 35 | Apr 15 | Refrigeration cycle  
| QUIZ # 6 |
| 36 | Apr 17 | Turbojet cycle |
| 37 | Apr 19 | Thermodynamic relations  
| HW # 11 Due, HW # 12 Posted, HW # 11 Soln Posted (EOD) |
| 38 | Apr 22 | Clapeyron equations |
| 39 | Apr 24 | Thermodynamics of ideal gas mixture, properties of air |
| Revision 3 | Apr 26 | Final Review  
| HW # 12 Due, HW # 12 Soln Posted (EOD) |
| Final | May 1-5 | Final Exam (Lectures 1 – 39), Location TBD |
COURSE OBJECTIVES AND OUTCOMES

Course Objectives: (Mapping to Program Outcomes shown in brackets)

A. Appreciate the role of thermodynamics in engineering and society. [3c]
B. Understand the importance of thermodynamic properties and know how to use them. [2b]
C. Understand the First Law of Thermodynamics and know how to use it to solve engineering problems. [2b]
D. Understand the Second Law of Thermodynamics and know how to use it to solve engineering problems. [2b]
E. Apply the First and Second Laws to practical systems, including Rankine cycles, refrigeration cycles and gas cycles. [2e]
F. Develop fundamental engineering problem solving skills. [4d]

Course Outcomes: (Mapping to Course Objectives shown in brackets)

1. Obtain thermodynamic data necessary to solve thermodynamic problems and when necessary use appropriate approximations. These skills include the use of equations of state and/or tabulated property tables. [B]
2. Write the First Law of Thermodynamics in their appropriate forms for both closed system and control volume problem. [C]
3. Solve problems requiring First Law analysis that produce a simple single answer. [C]
4. Make appropriate assumptions when applying the First Law to a “real-world” problem. [C]
5. Write the Second Law of Thermodynamics in their appropriate forms for both closed system and control volume problem. [D]
6. Apply the Second Law to determine the performance limitations of a given thermodynamic system. [D]
7. Apply thermodynamic concepts to describe the performance of the individual components of an engineering system, e.g. a power plant, a jet engine, etc., and then relate that information to the overall performance of the entire system. [E]
8. Physically interpret and apply integrals and derivatives to solve thermodynamic problems. [F]
9. Translate complex word problems into an orderly and logical problem solving approach. [F]
10. Use software to solve thermodynamics problems. [F]

Program Outcomes: (Asterisks show outcomes that are assessed for Program Assessment)

2b. Analysis of thermal/fluids components**
2e. Analysis of thermal/fluids systems**
3c. Contemporary issues**
4d. Develop models and choose appropriate tools to implement, solve, and present those models
STATEMENT ON ACADEMIC INTEGRITY

It is a simple matter of personal integrity, but unfortunately there are a few out there that have no personal pride in their own work. Earning a C is far more satisfying than stealing an A. Academic honesty and integrity is of utmost importance. Detailed information on this topic can be found at www.engr.psu.edu/undergrad/acad_int/students. Some examples are given below:

CHEATING: Using crib sheet; pre-programming a calculator; using notes or books during a closed book exam etc.
COPYING ON TEST: Looking at another unsuspecting student’s exam and copying; copying in a complicit manner with another student; exchanging color-coded exams for the purpose of copying; passing answers via notes; discussing answers in exam, etc.
PLAGIARISM: The fabrication of information and citations; submitting others work from professional journals, books, articles and papers; submission of other students papers or lab results or project reports and representing the work as one’s own; fabricating in part or total, submissions and citing them falsely, etc.
ACTS OF AIDING OR ABEADING: Facilitating acts by others; unauthorized collaboration of work; permitting another to copy from exam; writing a paper for another; inappropriately collaborating on home assignment or exam without permission or when prohibited, etc.
UNAUTHORIZED POSSESSION: Of examinations, through purchase or supply; stealing exams; failing to return exams on file; selling exams; photocopying exams; buying exams; any possession of an exam without the custodian’s permission, etc.
SUBMITTING PREVIOUS WORK: Submitting a paper, case study, lab report or any assignment that had been submitted for credit in a prior class without the knowledge and permission of the instructor.
TAMPERING WITH WORK: Changing own or another students work product such as lab results, papers, or test answers; tampering with work either as a prank or in order to sabotage another work, etc.
GHOSTING: Taking a quiz, an exam, performing a laboratory exercise or similar evaluation in place of another; having another take a quiz, an exam, or perform an exercise or similar evaluation in place of the student, etc.
ALTERING EXAMS: When instructor returns graded exams for in class review and subsequently collects them, student changes incorrect answers and seeks favorable grade adjustment asserting that instructor made mistake in grading; other forms may include changing the letter or and/numerical grade on test; obtaining test in discretely, etc.
COMPUTER THEFT PROGRAM: Electronic theft of computer programs, data, or text belonging to another etc.

STATEMENT ON ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. The Office for Disability Services (ODS) Web site provides contact information for every Penn State campus: http://equity.psu.edu/ods/dcl. For further information, please visit the Office for Disability Services Web site: http://equity.psu.edu/ods.

In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: http://equity.psu.edu/ods/doc-guidelines. If the documentation supports your request for reasonable accommodations, your campus’s disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. You must follow this process for every semester that you request accommodations.
ADVICE FROM THE STUDENTS OF ME300 – FALL 2014

— “Do, like actually do, the homework. And start it earlier than Thursday.”

— “Read the book before class.”

— “Focus in class. Take good notes, they will help you on your homework, which prepare you for the tests.”

— “Find somebody you know in the course or make friends. This class is much tougher without somebody to bounce an idea off.”

— “Learn assumptions and do not neglect the saturation tables! Learn phase changes EARLY in the course… or you will be doomed.”

— “Seriously start the homework early and then go to office hours. They’re super helpful and the homeworks end up getting really involved.”

— “Read the book thoroughly and carefully before doing all the homeworks. It really helps understand the concepts and learn the various equations.”

— “Learn to love Table D.2”

— “Pay attention to signs and units.”

— “Go over notes after each class to make sure you understand the content. When you understand the concept it’s easy to solve questions.”

— “Understand the material by relating it to real life.”

— “Start homework EARLY, go to office hours, and take clear, good notes. Go to review sessions to clarify notes.”

— “Come to class and come to class on time.

— “It’s not about finding the answer, it’s about understanding the question. Do not miss class

— “For honors students, the project was actually enjoyable and worth doing for honors credit. I recommend HO-ing this class.”

— “Have faith that it will all make sense in the end!”