Instructor: Dr. Daniel Forciniti  
Office: Room G36  
E-mail: Forcinit@mst.edu  
Office Hours: To be Arranged.

Course Description: The students will be introduced to the principles of thermodynamics and to the application of the science to chemical engineering problems. Emphasis is put on the calculation of phase equilibrium and on the thermodynamic analysis of processes.

Course Objectives: The students will be able to calculate thermodynamic properties of pure substances, will be able analyze pumps, turbines and heat exchangers, and will be able to set up and solve phase equilibrium problems for pure substances.

Keys to Success. Students in this class are expected to have a solid knowledge of algebra and calculus. Students should be able to solve mass balances. The students are expected to spend up to nine hours a week working on homework and reading the relevant material. The chances of success will drop significantly if the student does not keep the pace of the course.

Textbook  

Final Grade Make-up:  

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>15 %</td>
</tr>
<tr>
<td>Tests (3)</td>
<td>45 %</td>
</tr>
<tr>
<td>Final</td>
<td>40 %</td>
</tr>
</tbody>
</table>

Grade distribution:  
85 to 100% : A  
65 to 84%: B  
50 to 64%: C  
40 to 49%: D  
0 to 39 : F

Notes:  

a) Attendance is not mandatory.  
b) You will not be allowed to enter the classroom late.  
c) I will not give you a grade; you will earn it.  
d) You must work on your homework alone. Discussions with others are healthy, but copying others’ work is not.
e) Homework are due seven days after they are hand out. They will be graded and returned to you in the following class. Any material that is not picked up when it is distributed will be shredded.

f) Homework must be neatly done. Any person with general chemical engineering knowledge should be able to follow your work. Homework that does not meet minimum requirements will be returned without a grade.

g) You must try to understand the material on your own. Lectures, textbooks, and homework will help you.

h) All tests (including the final) are closed book and notes.

i) The final will cover Units 1 to 6. **You must get at least 40 points (over 100) in the final to get a grade of D or better (independently of your performance during the semester).** I will keep your final for one week after the first day of classes of the Fall semester. After that, your work will be shredded.

j) Below average performance in this course will start an Academic Alert System warning. You will be asked to meet with your academic adviser to resolve the problem.

k) If you have a documented disability and anticipate needing accommodations in this course, you are strongly encouraged to meet with me early in the semester. You will need to request that the Disability Services staff send a letter to me verifying your disability and specifying the accommodation you will need before I can arrange your accommodation.

l) All cases of academic dishonesty will be treated according to the Student Academic Regulations handbook, which describes the student standard of conduct relative to the System's Collected Rules and Regulations section 200.010, and offers descriptions of academic dishonesty including cheating, plagiarism or sabotage.

**Contact Persons:** You should try to resolve any problems that you have in this class with me. If you do not get satisfactory answer, you may contact:

Dr. D. Ludlow (Acting Chair), Chemical and Biological Engineering Department, 143 Schrenk Hall

**Course Outline**
<table>
<thead>
<tr>
<th>Unit</th>
<th>Topics</th>
<th>Reading</th>
<th>Date</th>
<th>HW</th>
</tr>
</thead>
</table>
| 1. Some Definitions | Temperature  
Heat and Work  
| 2. First Law | Open and Closed Systems  
Potential, Kinetic, and Internal Energy  
The Energy Balance  
Enthalpy  
Examples | Chapter 3  
3.1. Conservation of Energy  
6.3. Ideal gas and absolute temperature.  
Illustrations: 3.2.-2. 3.2.3. 3.4.3, 3.4.5, 3.4.6, 3.4.8. | Sep 3-5  
Sep 8-12  
Sep 15,17 | 1 |
| 3. Second Law | Entropy  
Reversible and Irreversible Processes  
Thermodynamics of Spontaneous Processes  
Generation of Entropy  
The Entropy Balance  
Lost Work (Exergy)  
Examples | Chapter 4  
Pages 98-109.  
Pages 127-135.  
**FIRST TEST: OCTOBER 1**. | Sep 19  
Sep 22-26  
Sep 29 | 2 |
| 4. Other Potentials | Helmholtz Free Energy  
Gibbs Free Energy  
The Fundamental Equation of Thermodynamics  
The Thermodynamics Network  
Maxwell Relationships | Chapter 3. Illustration 3.4.1  
Chapter 4: Pages 110-113  
Chapter 6: Pages 187-206 | Oct 3  
Oct 6-10  
Oct 13 | 3 |
| 5. Applications I | Pumps, Compressors, and Turbines  
Power Generation Cycles  
Refrigeration Cycles  
Liquefaction | Chapter 2, pages 54-55  
Chapter 4. Pages 136-139  
Chapter 5: 147-173  
**SECOND TEST: OCTOBER 31st** | Oct 15,17  
Oct 20-24  
Oct 27,29 | 4 |
| 6. Applications II | Thermodynamics of Pure Substances  
Ideal Gases  
Phase Equilibrium  
Equations of State  
Construction of tables of thermo properties (residual properties)  
Phase Transitions  
Fugacity | Chapter 3. Pages 59-69  
Chapter 4. Pages 124-127  
Chapter 6. Pages 207-259  
Chapter 7. Pages 268-276, 283-323  
**THIRD TEST: DECEMBER 5th** | Nov 3-7  
Nov 10-14  
Nov 21  
Dec 1,4 | 5 |