BE-381 Section 001
Biophysical Phenomena: Thermodynamics and Heat Transfer*
Fall 2008 (v. 1.1)

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Office Hours: TWR 10:00 to 11:00 and R 1:00 to 3:00 and other time by request (I recommend you phone or e-mail first in either case).
Textbook: Fundamentals of Thermal-Fluid Sciences. 3rd Ed. Cengal, Turner, & Cimbala. McGraw-Hill. 2008.
Prerequisites: BE-205; PH-220
Course Room: R-301 (We need the exercise…)
Course Times: Monday-Thursday 9:00-9:50 am
Final Exam: Tuesday, November 18, 8:00-10:00 am (we'll confirm this later)

***Course Description:** This is the first of a two-part series of courses in biophysical phenomena. The series covers thermodynamics and heat, mass, and momentum transport. The series has been restructured to follow the order of topics in the textbook, such that BE-381 now includes thermodynamics and introductory fluid mechanics.

Course Objectives: Upon completion of this course, students should be able to:

(1) Define thermodynamics and give examples of problems that can be solved using thermodynamic principles.
(2) State the First Law of thermodynamics and apply it to open and closed systems.
(3) Determine the properties of pure substances using steam tables, T-v diagrams and h-T diagrams.
(4) Determine the properties of pure ideal gases and mixtures of ideal gases.
(5) Determine the properties of gas-vapor mixtures.
(6) State the Second Law of thermodynamics and use it to solve engineering problems.
(7) Use the phase rule to determine the number of degrees of freedom for a non-reacting mixture at equilibrium.
(8) Use phase diagrams and property tables to determine the phases present in a mixture, their relative abundances and the properties of the mixture.
(9) Use the principles of thermodynamics to solve relevant biomedical engineering problems.
(10) Use psychometric analysis to define the vapor content of atmospheric air and apply this to the air conditioning process.
(11) Solve fluid flow problems involving the mechanical energy balance and Bernoulli equations.

Grading:

Homework	26% (including probable research assignment)
Exams	40%
In-Class Problems	4%
Comprehensive Final	30%

Homework:

Several homework assignments will be given throughout the course. You are allowed to collaborate with your classmates on assignments, but you are not allowed to copy their completed solutions (verbatim or otherwise). You are also not allowed to use any other prepared solutions from previous students or elsewhere. Each homework submission must include a completed and signed Homework Resource Disclosure Form. These forms can be downloaded from My.MSOE (as of 9/08 I can't find them online) and will be available from the instructor on request. Homework assignments will not be accepted without one of these forms.

Late Policy:

Late homework and projects will be penalized 10% if submitted within one day of the submission deadline and 20% if submitted within two days of the deadline, etc. up to a maximum of 50%. Under circumstances in which homework will be graded and returned within two days of submission, they will be accepted with a 50% penalty.

In-Class Assignments:

There will be frequent in-class activities to break up the lectures and enhance learning. You are expected to make a reasonable attempt to solve the problems posed. These problems will be collected and graded as follows:

0 points	No effort/not present
1 point	Minimal effort
2 points	Reasonable effort
3 points	Reasonable effort with some success
4 points	Completely correct

The earned points will be averaged at the end of the term.

Attendance:

Attendance records will not normally be kept. You are responsible for *all* announcements made during class if you miss. You will receive zero points for in-class assignments if you absent (whether excused or not). Make-up exams will only be given under extenuating circumstances and if pre-arranged.

Class Conduct:

Laptop use is not permitted in class, except during announced laptop activities. You will receive a deduction of up to 10 points from your earned in-class assignment points for any of the following violations:

- Use of a laptop when not permitted or for uses other than the specified activity when permitted
- Use of a cell phone or ringing of a cell phone (one warning for the latter)
- Ringing of a cell phone during an exam
- Conduct that is disruptive to the class, as judged by the instructor

Grading:

I use brake point grading in this course as described in my Standard Course Policies handout (available on the web at http://people.msoe.edu/~tritt/policies.pdf).

Miscellaneous:

- If you stop attending class, I will not drop you from the course; it is your responsibility to do so.
- If you have questions about grading, please report them to me immediately. I will only adjust grades if I have marked yours inconsistently relative to the rest of the class.
- Exams will be closed book and notes; however, you will generally be allowed to use a single 8.5" by 11" crib sheet. Any necessary charts or tables will be provided.
- Supporting material for the course, including lecture note worksheets, will generally be made available online through the course website at http://people.msoe.edu/~tritt/be381/index.html. Please let me know ASAP if you have any trouble finding this material. You can test it today by looking for this syllabus.
- Please bring your textbook and calculator to class each day. We will have many problem-solving sessions in class that make heavy use of tables in the book.

***Tentative* BE-381 Course Outline:**

Week	Day	Date	Chapter	Topic
1	1	9/8	1	Course Intro and Overview, Problem Solving
	2	9/9	1,2	Intro to EES, Thermo Definitions (handout), Temp Scales
	3	9/10	2	Intro to Pressure, Pascal's Law
	4	9/11	2	Manometers, Pressure Measurement
2	1	9/15	3	Energy, Energy Transfer, and General Energy Analysis
	2	9/16	3	Energy, Energy Transfer, and General Energy Analysis
	3	9/17	3	Energy, Energy Transfer, and General Energy Analysis
	4	9/18	4	Properties of Pure Substance
3	1	9/22	4	Properties of Pure Substance
	2	9/23	4	Properties of Pure Substance
	3	9/24	5	Energy Analysis of Closed Systems
	4	9/25	5	Energy Analysis of Closed Systems
4	1	9/29	5	Energy Analysis of Closed Systems
	2	9/30		**Exam 1: Chapters 1-4**
	3	10/1	5	Energy Analysis of Closed Systems
	4	10/2	6	Mass and Energy Analysis of Control Volumes
5	1	10/6	6	Mass and Energy Analysis of Control Volumes
	2	10/7	6	Mass and Energy Analysis of Control Volumes
	3	10/8	6	Mass and Energy Analysis of Control Volumes
	4	10/9	7	The second law of thermodynamics
6	1	10/13	7	The second law of thermodynamics
	2	10/14	7	The second law of thermodynamics
	3	10/15	8	Entropy
	4	10/16	8	Entropy
7	1	10/20	8	Entropy
	2	10/21		**Exam 2: Chapters 5-7**
	3	10/22	8	Vapor Compression Refrigeration – Entropy Application
	4	10/23	24*	Gas mixtures and phychometrics
8	1	10/27	24*	Gas mixtures and psychometrics
	2	10/28	24*	Gas mixtures and psychometrics
	3	10/29	24*	Gas mixtures and phychometrics
	4	10/30	12	Bernoulli and energy equations
9	1	11/3	12	Bernoulli and energy equations
	2	11/4	12	Bernoulli and energy equations
	3	11/5	10	Fluid Statics
	4	11/6		**Exam 3: Chapters 8 & 12, Gas Mixtures/Psychometrics**
10	1	11/10	10	Fluid Statics
	2	11/11	10	Fluid Statics
	3	11/12	9	Introduction to fluid mechanics
	4	11/13	9	Introduction to fluid mechanics
11		11/18	Final Comprehensive Exam 8:00 to 10:00 am	

* This chapter may be downloaded from the BE381 subfolder of my faculty OUT folder