PHYS 535 - THERMODYNAMICS FOR EDUCATORS: SYLLABUS

Spring, 2015; Section 401, Call # 22119; T 5:30-8pm

INSTRUCTOR: Dr. William Newton
OFFICE: Commerce campus, STC 236
PHONE: 903-886-5369
EMAIL: `william.newton@tamuc.edu`

LOCATION: MPLX 214

OFFICE HOURS: I will make time for questions about homework problems or anything else at the end of each class. I will also reply to questions over email within 24 hours.

TEXTBOOK: Concepts in Thermal Physics by Stephen Blundell and Katherine Blundell, ISBN-13: 978-0199562107

STUDENT LEARNING OUTCOMES:

- Students will be able to correctly define energy, heat, functions of state and other thermodynamic quantities.
- Students will be able to correctly apply the first law of thermodynamics in thermodynamical problems.
- Students will be able to correctly apply the second law of thermodynamics in thermodynamical problems.
- Students will be able to apply the statistical description of velocities of atoms and molecules to derive the pressure of a fluid and its effusion, diffusion and viscosity coefficients.
- Students will be able to construct the relevant partition functions of a given physical system and use it to derive thermodynamic quantities.

COURSE DETAILS

Thermodynamics is the study of the flow of heat between physical systems, and the effects of those flows. It encompasses the variety of ways one can compress, expand, heat and cool fluids and the ways in which one can extract or impart energy to systems. The most immediately practical application of thermodynamics involves the quantification of the amount of useful energy (work) a system can impart, a consequence that led, upon the scientific development of thermodynamics, directly to the industrial revolution and the modern world. In doing so, the far-reaching concept of entropy is introduced, the quantification of the amount of energy not available to do work - the amount of disorder in a physical system.

Kinetic theory and statistical mechanics seek to derive the laws of thermodynamics from more fundamental considerations of the underlying motions and energy states of the microscopic constituents of the system. Due to the fact that most physical systems are made up of far too large a number of constituents to describe each one individually, statistical methods have to be employed. The distribution of velocities and, more generally, energy states, among the constituents can be described mathematically described and hence the average properties of the constituents as a whole can be derived and macroscopic quantities such as pressure emerge.

CLASS REQUIREMENTS: The main mathematical requirements will be algebra, calculus and occasionally ordinary differential equations. For the latter, background material will be presented in class. Access to computer and internet connection will also be necessary.

ASSIGNMENTS AND GRADING:

(The following is to be taken as *quite* tentative).

There will be homework assignments every other week. There will be in-class worksheets to reinforce certain important concepts. There will be occasional longer projects that will be completed over the course of 3-4weeks, in lieu of tests. The final will be a take-home test.
Grading will roughly break down as:

40% Homework assignments
30% Projects/Tests
30% Participation (assessed through in-class worksheets)

ADA STATEMENT: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring an accommodation, please contact:

Office of Student Disability Resources and Services
Texas A&M University-Commerce
Gee Library
Room 132
Phone (903) 886-5150 or (903) 886-5835
Fax (903) 468-8148
`StudentDisabilityServices@tamuc.edu`

UNIVERSITY POLICIES

- All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment. (See Student's Guide Handbook, Policies and Procedures, Conduct). Rude or disruptive behavior will NOT be tolerated.
- Texas A&M University-Commerce does not tolerate plagiarism and other forms of academic dishonesty. Conduct that violates generally accepted standards of academic honesty is defined as academic dishonesty."Academic dishonesty" includes, but is not limited to, plagiarism (the appropriation or stealing of the ideas or words of another and passing them off as one's own), cheating on exams or other course assignments, collusion (the unauthorized collaboration with others in preparing course assignments), and abuse (destruction, defacing, or removal) of resource material.
- A&M-Commerce will comply in the classroom, and in online courses, with all federal and state laws prohibiting discrimination and related retaliation on the basis of race, color, religion, sex, national origin, disability, age, genetic information or veteran status. Further, an environment free from discrimination on the basis of sexual orientation, gender identity, or gender expression will be maintained.

(TENTATIVE) CLASS SCHEDULE:

Subject	Class	Chapter
Definitions and preliminaries: heat, the thermodynamic limit, temperature and thermal equilibrium, functions of state	1	1,2,4,11
The first law of thermodynamics; adiabatic and isothermal expansion	2	11,12
The second law of thermodynamics I: heat engines	3	13
The second law of thermodynamics II: entropy	4	14
Thermodynamics potentials	5	16
First and second law in practice	6	
Kinetic theory I: The Maxwell-Boltzmann distribution; pressure, the ideal gas equation of state	7	5,6
Kinetic theory II: Effusion, cross-sections in an ideal gas	8	7,8
Thermal transport and diffusion	9	9,10
Kinetic theory and thermal transport in action	10	
Statistical mechanics I: Equipartition and the partition function	11	19,20
Statistical mechanics II: Ideal gas and chemical potential	12	21,22
Statistical mechanics III: Photons and phonons	13	23,24
Statistical mechanics IV: Bose-Einstein distribution	14	29,30
Statistical mechanics V: Bose-Einstein distribution	15	29,30