**SYLLABUS**

Thermal Physics – CRN3697, PHY308-101

Time: TR: 11:00 am – 12:15 pm, Fall 2018

Location: S281

**Instructor**

Thomas E Wilson, Ph.D.

Office: S153

Lab: S154

Phone: 696-2752

E-mail: wilsont@marshall.edu

**Office Hours**

Tentatively, MWF 3:00-4:00 pm or by appointment.

**Text**

*Introduction to Thermal Physics*, 5th edition, Schroeder (Addison Wesley).

**Overview**

I will act as your guide, as we will teach each other according to our individual skill sets. The level of the course will be aimed at students who have completed the introductory calculus-based physics sequence. One should be conversant with *partial* derivatives and common integrals. The assigned problems can be conceptually challenging to formulate (compared to say a typical PHY213 problem statement) so please plan to invest between 3-5 hours per week on them.

**Attendance**

Attendance of all class meetings is expected, but allowance will be made for extenuating circumstances. Students are responsible for material presented in lecture, whether they are in attendance or not.

**Academic Integrity**

Do not plagiarize by submitting any online (full or partial) solutions to end-of-chapter problems.

**Grade Determination**:

An unexcused (lack of a notification to me from the Dean of Student’s Office) absence for an exam will result in a score of 0%. Arrangements can be made for a make-up exam for an excused absence – typically, one’s next exam will count double.

 Homework (including in-class solutions on the board): 10%

 Exams: Each will count 20% for a total of 60%.

 Final: 30%

 A=90%, B=80%, C=70%, D=60%, F<60%.

**Assigned Homework**

Home work will be assigned weekly. I may only be able to grade a single problem due to time constraints, although most of the problems will be solved in class later. I may ask for volunteers on Thursdays typically, to present assigned problem solutions at the blackboard. Points will be given for accuracy, clarity, and adequate verbal description and defense of one’s solutions.

**Exam Schedule (closed-book)**

Exam I: Tuesday, September 18

Exam II: Tuesday, October 16

Exam III: Tuesday, November 12

Comprehensive Final Exam: TR December 13 (10:15 am – 12:15 pm)

**Topics Covered from Chapters 1-6**

|  |
| --- |
| Part I: Fundamentals* Chapter 1: Energy in Thermal Physics. An overview of temperature, ideal gases, equipartition, the first law, heat capacities, and transport processes.
* Chapter 2: The Second Law. Fundamental statistical ideas applied to two-state systems and the Einstein solid model; analysis of two interacting Einstein solids, leading to the second law; multiplicity of an ideal gas; statistical definition of entropy.
* Chapter 3: Interactions and Implications. Temperature, pressure, and chemical potential as partial derivatives of the entropy; the relation between entropy and heat; prediction of heat capacities and other thermal properties of a paramagnet, Einstein solid, and ideal gas (all microcanonical).

Part II: Thermodynamics* Chapter 4: Engines and Refrigerators. Derivation of limits on efficiency from the laws of thermodynamics; Carnot cycle; realistic cycles for internal combustion engines, steam engines, and refrigeration; methods of reaching very low temperatures.
* Chapter 5: Free Energy and Chemical Thermodynamics. Definitions and interpretations of Helmholtz and Gibbs free energies; applications to electrochemistry, phase transformations, mixtures, dilute solutions, and chemical equilibrium.

Part III: Statistical Mechanics* (Time permitting) Chapter 6: Boltzmann Statistics. Boltzmann factors and partition functions, including applications to atomic and molecular excitations, paramagnetism, equipartition theorem, Maxwell distribution, ideal gases.
* (Time permitting) Chapter 7: Quantum Statistics. Gibbs factors; Fermi-Dirac and Bose-Einstein distributions; degenerate electron gases; blackbody radiation; Debye theory; Bose-Einstein condensation.
 |