### PHYSICS 628:

#### ADVANCED THERMODYNAMICS AND STATISTICAL MECHANICS

Instructor:Dr. Ostrovskii, IgorLecture:MWF 9:00 – 9:50 a.m., Room 1128 NCPAOffice:Room 207 Lewis Hall, Tel: 915-1536; Email: iostrov@phy.olemiss.eduOffice Hours:MWF 2:30 – 3:30 p.m. (207 Lewis Hall)

**Recommended text:** Fundamentals of statistical and thermal physics, by F. Reif, McGraw-Hill This semester we will cover Chapters 9 - 15. PLEASE, READ THE BOOK

- <u>Grading Scale</u>: A's ------ 90 100 B's ----- 80 - 89% C's ----- 70 - 79%. Etc.
- <u>Grades will be based on homework, tests, and the final exam</u>:
  - Homework ------ 20% Three tests ----- 50% (#1=20%, #2=15%, #3=15%) Final exam ----- 30%
- <u>Tests and Final exam schedule:</u> Test #1, Ch. 8 - 10 ----- Monday, February 16 Test #2, Ch. 11 - 13 ----- Monday, March 29 Test #3, Ch. 14 - 15 ----- Friday, April 23
  - Final Examination ------ Friday, May 7, 2004, 8 a.m. (Room 1128 NCPA)

#### **Homework Rules:**

- 1. Homework is assigned after some sections are covered and is due next week.
- Homework <u>answers should have</u>: 1) initial equations, 2) explanations, 3) calculations,
   4) final expressions, 5) answers in numbers and units.
- 3. Show all your work; the answer alone is not worth anything. Homework problems must include <u>enough English</u> to be understandable.
- 4. Circle the answers that you want to be graded.

## **SYLLABUS**

<ul> <li>Ch. 8. EQUILIBRIUM BETWEEN PHASES OR CHEMICAL SPECIES</li> <li>General equilibrium conditions.</li> <li>Equilibrium between phases.</li> </ul>	[2 classes]
<ul> <li>Ch. 9. QUANTUM STATISTICS OF IDEAL GAS</li> <li>Maxwell-Boltzmann, Boze-Einstine, and Fermi-Dirac statistics.</li> <li>Ideal Gas in Classical Limit.</li> <li>Black-Body Radiation.</li> <li>Conduction Electrons in Metals.</li> </ul>	[8 classes]
<ul> <li>Ch. 10. SYSTEMS OF INTERACTING PARTICLES</li> <li>Solids, Lattice vibrations.</li> <li>Nonideal Classical Gas.</li> <li>Ferromagnetism.</li> </ul>	[5 classes]
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Ch. 11. MAGNETISM AND LOW TEMPERATURE

[3 classes]

- Magnetic work and Magnetic cooling.
- Measurement of very low absolute temperature.
- Superconductivity.

Ch. 12. ELEMENTARY KINETIC THEORY OF TRANSPORT PROCESSES [6 classes] • Collision time and Scattering cross section. • Viscosity and Thermal conductivity. • Self-diffusion. • Electrical conductivity. Ch. 13. TRANSPORT THEORY USING THE RELAXATION TIME APPROXIMATION [5 classes] Transport processes. • • Boltzmann equation in the absence of collisions. • Boltzmann differential, examples. TEST 2, Chs. 11 - 13  $\rightarrow$  Monday, March 29 Ch. 14. NEAR-EXACT FORMULATION OF TRANSPORT THEORY [6 classes] • Description of two-particle collisions. • Scattering cross sections. • Boltzmann equation. • Equation of charge for mean values. Approximation methods, examples. • Ch. 15-A. SIMPLE APPLICATIONS OF STATISTICAL METHODS [3 classes] Transition probabilities and master equation. Simple discussion of Brownian motion. • TEST 3, Chs. 14 – 15A  $\rightarrow$  Friday, April 23 Ch. 15-B. SIMPLE APPLICATIONS OF STATISTICAL METHODS [2 classes] Fourier analysis of random functions. • 16. REVIEW [1 class]

# *FINAL EXAM: Chs. 8 – 15 → Friday, May 7, 8 a.m. (Room 1128 NCPA)*

\* - The dates of three tests are tentative, and may be changed.