Introduction to Modern Physics II

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• Instructor: Dr. Igor Ostrovskii

Course objectives:

- 1. Introduce the physics major students to 20-th century physics;
- 2. Expand an understanding of the intuitive ideas of quantum physics;
- 3. Develop an understanding of the current basis of broad knowledge in physics including solid state, nuclear structure and applications, particle physics;
- 4. Discuss the problems confronting physics in the 21-st century.
 - ★ Lecture: TTh 8:00 9:15, Room 109 Lewis Hall
 - ♦ Office: Room 207 Lewis Hall, Tel: 915-1536; Email: iostrov@phy.olemiss.edu
 - ♦ Office Hours: MWF 2:30 3:30 p.m. (207 Lewis Hall)
- Text: Modern Physics, by R.A. Serway, C.J. Moses and C.A. Moyer, Third edition.
- Additional reading: David Griffits. Introduction to Elementary Particles.

We will cover Chapters 10 – 15.

PLEASE, READ THE BOOK

- <u>Grading Scale</u>: A ------ 90 100 B ------ 80 - 89 C ----- 70 - 79 D ----- 60 - 69, Etc.
- Grades will be based on homework, tests, and the final examination:

Homework ------ 15% Three tests ------ 45% (#1=15%, #2=15%, #3=15%) Final exam ------ $\frac{40\%}{100}$

• <u>Tests and Final examination schedule:</u>

TEST 1: (Class # 11) Chapters 10, 11, 12-A → Tuesday, February 21 TEST 2: (Class # 20) Chapters 12-B, 13 → Thursday, March 30

TEST 3: (Class #29) Chapters 14, 15 → Tuesday, May 2

> FINAL EXAMINATION ----- Tuesday, May 9, 8:00 a.m.

- Homework Rules:
- 1. Homework is assigned after some sections are covered and is due in a week.
- 2. Homework paper should be 8.5 x 11 inches with no torn or tattered edges. Homework papers should be <u>stapled</u>.
- 3. Show all your work; the answer alone is not worth anything. Homework problems must include <u>enough English</u> to be understandable.
- 4. Homework answers should have units and a reasonable number of significant digits.
- 5. <u>Circle the finale answers that you want to be graded.</u>

SYLLABUS

- Ch. 10. STATISTICAL PHYSICS
 - The Maxwell-Boltzmann distribution.
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 - Quantum statistics. Applications of Bose-Einstein statistics. Application of Fermi-Dirac statistics. •
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Ch. 11. MOLECULAR STRUCTURE

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- Bonding mechanisms. Molecular Rotation and Vibration. Molecular Spectra. Electron Sharing and the Covalent Bond. •

Ch. 12-A. THE SOLID STATE I (Sections 12.1, 2, 3)

- Bonding in solids. Classical Free-Electron Model. .
- Quantum Theory of Metals. •

TEST 1: (Class # 11) Chapters 10, 11, 12-A → Tuesday, February 21

Ch. 12-B. THE SOLID STATE II (Sections 12.4, 5, 6, 7)

- Band Theory of solids.
- Semiconductor Devices. •
- Superconductivity. •
- Lasers.

Ch. 13. NUCLEAR STRUCTURE

- Properties of nuclei. Binding energy and nuclear forces. Radioactivity, Decay process, Natural radioactivity. .

TEST 2: (Class # 20) Chapters 12-B, 13 → Thursday, March 30.

Ch. 14. NUCLEAR PHYSICS APPLICATIONS

- Nuclear reactions, Reaction cross section, Interactions & Neutrons. Nuclear fission, Nuclear reactors. Nuclear fusion. Interaction of particles and matter, Radiation damage. Radiation detectors, Uses of radiation.
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Ch. 15. ELEMENTARY PARTICLES

- The fundamental forces in nature.
- Antiparticles. Mesons.
- Classification of particles. •
- Conservation Laws.
- Ouarks.
- Electroweak theory and the standard model.

TEST 3: (Class #29) Chapters 14, 15 → Tuesday, May 2.

REVIEW

[Last class]

★ FINAL EXAMINATION: Chapters 10 - 15 → Tuesday, May 9, 8:00 a.m.

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

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