PHYSICS 318: **SPRING - 2004**

INTRODUCTION TO MODERN PHYSICS II

- **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;
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, 2nd edition.

We will cover Chapters 7 - 12.

PLEASE, READ THE BOOK

- Grading Scale: A's ---------- 90 – 100
  B's ---------- 80 – 89
  C's ---------- 70 – 79, Etc.

- Grades will be based on homework, tests, and the final examination:
  Homework ---------- 20%
  Three tests ---------- 45% (#1=15%, #2=15%, #3=15%)
  Final exam ---------- 35%
  100

- Tests and Final examination schedule:

Test 1 (Class # 9), Chapters 7, 8 ---------- Thursday, February 5.
Test 2 (Class # 20), Chapters 9, 10, 11A ---------- Tuesday, March 23.
Test 3 (Class # 29), Chapters 11B, 12 ----------Tuesday, April 27.

➢ **FINAL EXAMINATION ---------- Wednesday, May 5, 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 stapled.
3. Show all your work; the answer alone is not worth anything. Homework problems must include enough English to be understandable.
4. Homework answers should have units and a reasonable number of significant digits.
5. **Circle the finale answers that you want to be graded.**

SYLLABUS

Ch. 7. QUANTUM MECHANICS IN THREE DIMENSIONS [4 classes]

- Particle in a three-dimensional box.
- Central forces, angular momentum, space quantization.
- Atomic hydrogen and hydrogen-like ions.

Ch. 8. ATOMIC STRUCTURE [4 classes]

- Orbital magnetism, Normal Zeeman effect.
- The spinning electron, the spin-orbit interaction, exchange symmetry.
- The periodic table, X-ray spectra, Moseley's Law.

TEST 1: Chapters 7 – 8 → Thursday, February 5.

Ch. 9. STATISTICAL PHYSICS [4 classes]

- The Maxwell-Boltzmann distribution.
- Quantum statistics.
- Applications of Bose-Einstein statistics.
- Application of Fermi-Dirac statistics.

Ch. 10. MOLECULAR STRUCTURE [3 classes]

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

Ch. 11-A. THE SOLID STATE I (Sections 11.1, 2, 3) [3 classes]

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

TEST 2: Chapters 9 – 11A → Tuesday, March 23.

Ch. 11-B. THE SOLID STATE II (Sections 11.4, 5, 6) [4 classes]

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

Ch. 12. SUPERCONDUCTIVITY [4 classes]

- Magnetism in Matter. History of Superconductivity.
- Properties of Type I and Type II Superconductors.
- Other Properties of Superconductors. BCS Theory. Energy Gap Measurements.
- Josephson Tunneling. High-Temperature Superconductors. Applications.

TEST 3: Chapters 11B, 12 → Tuesday, April 27.

REVIEW [1 class]

❖ **FINAL EXAMINATION: Chapters 7 – 12 → Wednesday, May 5, 8:00 a.m.**

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