PHYSICS 318: 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)

Additional reading: David Griffits. Introduction to Elementary Particles (Chapter 1).

We will cover Chapters 8 – 12, 15.

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%

Tests and Final examination schedule:

Test 1 (Class # 9), Chapters 8, 9 ------------------ Thursday, February 15.
Test 2 (Class # 20), Chapters 10, 11, 12-A ----------- Thursday, March 31.
Test 3 (Class # 29), Chapters 12B, 15 ---------------Tuesday, May 3.

FINAL EXAMINATION ---------------- Monday, 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 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. 8. 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. 9. 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: (Class # 9) Chapters 8 and 9 → Thursday, February 15.

Ch. 10. STATISTICAL PHYSICS [4 classes]
• The Maxwell-Boltzmann distribution.
• Quantum statistics.
• Applications of Bose-Einstein statistics.
• Application of Fermi-Dirac statistics.

Ch. 11. MOLECULAR STRUCTURE [3 classes]
• 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) [3 classes]
• Bonding in solids.
• Classical Free-Electron Model.
• Quantum Theory of Metals.

TEST 2: (Class #20) Chapters 10 – 12A → Thursday, March 31.

Ch. 12-B. THE SOLID STATE II (Sections 12.4, 5, 6, 7) [5 classes]
• Band Theory of solids.
• Semiconductor Devices.
• Superconductivity.
• Lasers.

Ch. 15. ELEMENTARY PARTICLES [3 classes]
• The fundamental forces in nature.
• Antiparticles. Mesons.
• Classification of particles.
• Conservation Laws.
• Quarks.
• Electroweak theory and the standard model.

TEST 3: (Class #29) Chapters 12B, 15 → Tuesday, May 3.

REVIEW [1 class]

◊ FINAL EXAMINATION: Chapters 8 – 12, 15 → Wednesday, May 5, 8:00 a.m.

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