INFORMATION TO MODERN PHYSICS I

- Instructor: Dr. Igor Ostrovskii

SYLLABUS

Course objectives:
1. Introduce the physics major students to 20-th century physics;
2. Expand an understanding of the intuitive ideas of the relativity and quantum physics;
3. Develop an understanding of the current basis of broad knowledge in physics;
4. Enhance the critical thinking, analytical reasoning and problem solving skills;
5. 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; Email: iostrov@phy.olemiss.edu
Office Hours: MWTh 2:30 – 3:30 p.m. (207 Lewis Hall)

We will cover Chapters 1 - 9.

PLEASE, READ THE BOOK

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

EVALUATION: Grades will be based on the homeworks, tests, and final examination:
Homework -------- 15 %
Three tests --------- 45 % (#1=15%, #2=15%, #3=15%)
Final exam ------- 40 %
100 %

Tests and Final examination schedule:
Test 1 (Class #11), Chapters 1, 2, 3, 4 --------------- Tuesday, September 27.
Test 2 (Class #20), Chapters 5, 6, 7 ----------- Thursday, October 27.
Test 3 (Class #26), Chapters 8, 9A --------------- Thursday, November 17.

FINAL EXAMINATION --------- Friday, December 9, 8:00 a.m.

Requirements of the course and 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.

Course content:
CHs. 1 & 2. RELATIVITY I AND II. [3 classes]
- Special relativity, the principles of relativity, experiments.
- Postulates of special relativity, The Lorentz transformation.
• Relativistic momentum and energy, conservation laws.

CH. 3. THE QUANTUM THEORY OF LIGHT. [2 classes]
• Hertz’s experiment.
• Black body radiation and Planck’s law.
• Photoelectric effect and associated phenomena.
• Particle-Wave Complementary.

CH. 4. THE PARTICLE NATURE OF MATTER. [4 classes]
• The atomic nature of matter, the composition of atoms.
• The Bohr atom.
• Direct confirmation of atomic energy.

Test 1 (Class # 11), Chapters 1, 2, 3, 4  --------------- Tuesday, September 27.

CH. 5. MATTER WAVES. [3 classes]
• The waves de Broglie, The Davisson-Germer experiment.
• Wave groups and dispersion.
• The Heisenberg uncertainty principle.
• The wave-particle duality.

CH. 6. QUANTUM MECHANICS IN ONE DIMENSION. [3 classes]
• The Born interpretation, wavefunctions.
• The Particle in a box, Finite square well, Quantum oscillator.
• Observables and operators.

CH. 7. TUNNELING PHENOMENA. [2 classes]
• The square barrier.
• Barrier penetration and some applications.

Test 2 (Class # 20), Chapters 5, 6, 7  --------------- Thursday, October 27.

CH. 8. QUANTUM MECHANICS IN THREE DIMENSIONS. [3 classes]
• Particle in a three-dimensional box.
• Central forces, angular momentum, space quantization.
• Atomic hydrogen and hydrogen-like ions.

CH. 9-A. ATOMIC STRUCTURE. [3 classes]
• Orbital magnetism, Normal Zeeman effect.
• The spinning electron, the spin-orbit interaction.
• Exchange symmetry.

Test 3 (Class # 26), Chapters 8, 9A  --------------- Thursday, November 17.

CH. 9-B. ATOMIC STRUCTURE. [1 classes]
• The periodic table, X-ray spectra, Moseley’s Law.

REVIEW

➢ FINAL EXAMINATION  8:00 a.m.

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