PHYSICS 317: **FALL - 2005**

INTRODUCTION 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)

- **Text**: Modern Physics, by R.A. Serway, C.J. Moses and C.A. Moyer, 3rd edition.

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 [1 Class]

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

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