SENIOR REVIEW (for Major Field Achievement Test in Physics)

- Instructor: Dr. Igor Ostrovskii
- Lecture: M,W 10:00 – 10:50, Room 109 Lewis Hall
- Office: Room 207 Lewis Hall; Email: iostrov@phy.olemiss.edu
- Office Hours: M,W,Th 3:00 – 4:00 p.m. (207 Lewis Hall)

- **Required text:** There is no required text.

- **Recommended texts:**

- **Additional reading:**
  5. David Griffiths. Introduction to Elementary Particles (Chapter 1).

- **Course learning objectives:**
  In the learning objectives, we answer a question: "What will the students know and be able to do as a result of taking this class?"
  1. Develop an understanding of a broad knowledge in current undergraduate Physics with emphasis to the diagrams, graphs, experimental data, and descriptions of physical situations.
  2. Review of the fundamental principles of undergraduate Physics.
  3. To develop in learners an ability to apply the fundamental physical principles for solving the specific problems with multiple-choice answer.
  4. Enhance the critical thinking, analytical reasoning, and problem solving skills for general problems, which require application of different principles across all undergraduate Physics.
  5. The Senior Review will stress usage of The International System (SI) of units for problem solving and main conversion factors among SI units.
  6. To develop in learners the specific skills to present their scientific knowledge, and to enhance their oral communication skills via the student presentations on a number of topics in undergraduate physics.
• **The learning outcomes for students:**

1. In depth understanding of fundamental physics principles at undergraduate level *including* Mechanics, Relativity, Electromagnetism, Optics and Waves, Thermodynamics and Statistical Mechanics, Quantum Mechanics, Atomic Physics, Crystal structure, Semiconductors, Superconductors, Nuclear properties, Particle physics.
2. Understanding of some miscellaneous topics including Astrophysics, Computer applications, Mathematical methods.
3. Ability to solve multiple-choice problems in undergraduate Physics.
4. Students will develop a comprehension of the current basis of broad knowledge in undergraduate Physics.
5. Learners will build on a problem solving skills based on critical thinking and analytical reasoning.
6. Students will know how to use the Internet for their independent learning on undergraduate Physics.

**GRADING:**

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

- Grades will be based on:

  1. **Attendance:** 0.8 points a day.  
     ------ max  20 points
  
  2. **Presentations:** main equations, principles and figures – 8 points; solutions to examples and test problems – 7 points; handout page(s) – 3 points; numbers worth learning – 1 point; math tricks and methods – 1 point.  
     ------ max  20 points
  
  3. **Study Notebook:**  
     ------ max  20 points
  
  4. **Test:** 25 problems/43 min, 0.8 points per problem solved  
     ------ max  20 points
  
  5. **Final exam:** Major Field Test (min 10 points)  
     ------ max  20 points

**TOTAL** 100 points

• **Tests and Final examination schedule:**

- **Test:** part A  (25 multiple-choice problems, 43 minutes) Class #15, March 11.

- **FINAL EXAMINATION  ➔  Wednesday, May 6, 8:00 a.m.**
COURSE CONTENTS:

❖ Part A. INTRODUCTORY PHYSICS

**Topic I. CLASSICAL MECHANICS AND RELATIVITY**

(4 classes)


**Topic II. ELECTROMAGNETISM**

(4 classes)


**Topic III. OPTICS, WAVES, THERMODYNAMICS, STATISTICAL MECHANICS**

(5 clas.)

- Geometrical optics. Wave properties, superposition; Diffraction; Interference; Polarization. Doppler effect.

**Test:** part A (25 multiple-choice problems, 43 minutes) Class#15, March 11.

❖ Part B. ADVANCED PHYSICS

**Topic IV. QUANTUM MECHANICS AND ATOMIC PHYSICS**

(6 classes)

**Topic V. SPECIAL TOPICS** (4 classes)

- Condensed matter physics (basic concepts, crystal structure, diffraction, free electron theory, semiconductors, superconductors, thermal properties).
- Nuclear and particle physics (fission and fusion, nuclear reactions, nuclear properties, radioactive decay, particles and interactions).
- Lagrangian and Hamiltonian formalism (Lagrangian, Lagrange's equations of motion, Hamiltonian, Hamilton's equations of motion).
- Laboratory methods (counting statistics, data and error analysis, dimensional analysis, electronics, instrumentation, lasers, probability and statistics, radiation detection).

**Topic VI. MISCELLANEOUS TOPICS** (1 class)


**REVIEW, and Research Ethics** (1 class)

**FINAL EXAMINATION: All Topics → Wednesday, May 6, 8:00 a.m.**

- The dates are tentative, and may be changed, **BUT NOT FINAL EXAMINATION.**