Course Outline for PHYS 552 (Theoretical Physics II)

Instructor: Emanuele Berti  
Office: 205 Lewis Hall  
Class Schedule: Tue & Thu 11:00am-12:15pm, Lewis Room 104  
Office Hours: By appointment  
Email: berti@phy.olemiss.edu  
Course Website: http://www.phy.olemiss.edu/~berti/teaching.html  
Phone: 662-915-1941

Prerequisite: Phys 308 or Graduate Status  
Course Credit Hours: 3

Textbooks:
(1) Mathematics of Classical and Quantum Physics, by Frederick W. Byron and Robert W. Fuller
(2) Mathematical Methods for Physicists by George B. Arfken and Hans J. Weber
(3) Advanced Mathematical Methods for Scientists and Engineers: Asymptotic Methods and Perturbation Theory, by Carl M. Bender and Steven A. Orszag

Other Useful Books:
(4) Methods of Theoretical Physics, by Philip McCord Morse and Herman Feshbach
(5) Methods of Mathematical Physics, by Richard Courant and David Hilbert
(6) Mathematics for Physicists, by Philippe Dennery and Andre Krzywicki

The main text for the course is Mathematics of Classical and Quantum Physics by Frederick W. Byron and Robert W. Fuller. We will also use Mathematical Methods for Physicists by George B. Arfken and Hans J. Weber (mainly as a reference) and Advanced Mathematical Methods for Scientists and Engineers by Carl M. Bender and Steven A. Orszag. In class I will point to selected chapters from the other books for a more advanced treatment of certain topics and complementary material.

Course Goals and Learning Outcome:
The course will cover some mathematical techniques commonly used in theoretical physics. This is not a course in pure mathematics, but rather on the application of mathematics to problems of interest in the physical sciences.

Preliminary Outline of the Course:
We will cover the following topics:
- Hilbert spaces: complete orthonormal sets of functions
- Special functions (Legendre polynomials, Fourier series and integrals, spherical harmonics...)
- Sturm-Liouville systems: orthogonal polynomials
- Green’s functions
- Elements of asymptotic analysis and perturbation theory

This is a course in mathematical physics, so the emphasis will always be on physical applications.
**Evaluation:**

**Grade Type:** Whole Letter Grade (A–F)

**Grade Ranges:**
- A: 88% and up
- B: 75-87%
- C: 60-74%
- D: 40-59%
- F: less than 40%

**Grade Percentage:**
- 60% Homework
- 10% Mid-term test
- 30% Final exam

**Homework, In-class Tests and Final Exam:**

Homework assignments will be announced in class, and they must be turned in at the beginning of class on the due date. Late homework will not be accepted. In exceptional cases students may be excused from turning in an assignment. Homework must be easy to read: please write down clearly your name and the problem set number, do not use a red pen, write consistently on either one side or both sides of the paper and staple the pages together. The final exam is open-book and will consist of problems to be worked out. Students will be allowed to use a calculator, and may be provided with an equation sheet by the instructor if necessary.

**Attendance:**

There is no strict attendance requirement, but you are strongly advised to attend class. If you miss an exam or cannot turn in homework, please inform me beforehand and get a doctor’s note if applicable.

**Academic Integrity:**

Violations of the University’s policy of academic integrity will result in a failing grade and other disciplinary actions. In particular, use of the Instructor’s Solution Manual is considered cheating. Students who use it will be subject to formal academic discipline charges.

**Note:**

If a change in the syllabus becomes necessary during the semester, it will be discussed in class and then posted on the course website. The course website will also contain up-to-date information on the class schedule, homework assignments and complementary material.