

# Physics 250

## Graduate Mathematical Methods

**Instructor:** Peter Young  
Office: ISB 212  
Phone: 459-4151  
E-mail: [peter@physics.ucsc.edu](mailto:peter@physics.ucsc.edu)

**Place:** Interdisciplinary Sciences Building, 231.

**Time:** Mondays, Wednesdays and Fridays, 9:30–10:40 am.

**Note:** Course materials, such as homework assignments, homework solutions, and handouts will be available at my web site

<http://bartok.ucsc.edu/peter/250/>

### Books

The recommended book for the course is

- **Graduate Mathematical Methods** by James J. Kelly.  
This book uses the more precise mathematical notation used by the powerful computer program *Mathematica*, rather than standard mathematical notation. It also contains lines of *Mathematica* code to obtain some results which are rather tedious to obtain by hand. You may find it useful to use *Mathematica* to check some of your calculations. *Mathematica* is available on the graduate student computers, as well as several of the computer labs on campus.

The book comes with a CD containing supplementary material, mainly in the form of *Mathematica* notebooks. For some information on how to use them look at the file “Introduction CD.doc” on the CD. If you want a short introduction to *Mathematica* look at “BasicMathematica.nb”. For a fuller introduction to *Mathematica* try Kelly’s web site

<http://www.physics.umd.edu/courses/CourseWare/EssentialMathematica/>

or a tutorial I wrote for a different class which is available at

[http://bartok.ucsc.edu/peter/115/math\\_intro.pdf](http://bartok.ucsc.edu/peter/115/math_intro.pdf)

Other useful books (available on reserve in the science library) are

- *Mathematics of classical and quantum physics*, by F.W. Byron and R.W. Fuller.
- *Mathematical Physics, a modern introduction to its foundation*, by S. Hassani.
- *Mathematics for Physicists*, by P. Dennery and A. Krzywicki.

- *Essential Mathematical Methods for Physicists*, by H.J. Weber and G.B. Arfken
- *Mathematical Methods for Physicists*, by G.B. Arfken and H.J. Weber

Another useful resource is the web site

<http://exampleproblems.com>,

which has many worked out problems in mathematics.

### Topics

The topics to be covered are:

- Complex analysis, Ch. 1.
- Contour integration, Ch. 2.
- Asymptotic series and method of steepest descent, Ch. 3.
- Dirac delta function, Ch. 4.
- Fourier and Laplace transforms, Ch. 5.
- Dispersion relations and related topics, Secs. 6.2, 6.4, 6.5.
- Green functions, Sec. 7.4.
- Boundary value problems, some of Ch. 9.
- Probability theory and statistics, with application to data analysis. (Not in the book but handouts will be provided.)
- (If time) Integral equations.

### Grading

Your performance in the class will be decided on the basis of the a final examination and weekly homework assignments as follows:

final	60%
homework	40%

The final exam will be closed book. You will be allowed to bring one sheet of hand written notes if you wish.

### Office Hour

The time of my office hours will be decided at the first class.