

Physics 501: Math Models of Physical Problems I

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Lectures: 9:30am TTh Physics 146 *except Sept 25, Oct 21 & 23.*
Make up lectures Fridays noon-1:15pm Sept 12, Sept 19, and Oct 1.

Office Hours: Tues 8:30-9:30am, Wed noon-1pm, and typically after class.

Topics: 0a. Linear algebra – eigenvalues & vectors, SVD & condition #
We'll do quick review in 1 day + homework set.
0b. Vector calculus – we'll review in class as much as needed.
1. Complex analysis, including but not limited to, convergence of series, residues, contour integrals, Γ -functions
2. Ordinary differential equations -
3. Partial differential equations – Laplace/Poisson, heat, wave
4. Orthogonal expansions/special functions – Fourier, Legendre, Bessel, Hermite, Laguerre, Chebyshev, Hypergeom, . . .

Textbooks: *Math Methods for Physicists*, Arfken & Weber. Material in this text is necessary, but not sufficient, for developing mathematical maturity.

Recommended background texts

Linear Algebra & Its Applications, by Strang, Harcourt-Brace-Jovanovich

Div, grad, curl and all that, by HM Schey, Norton

Calculus, by Edwards & Penney

Complex Variables, by Stephen Fisher, Wadsworth & Brooks/Cole

Mathematics Series

Elementary Differential Equations, by Boyce & DiPrima, Wiley

The Fourier Transform and Its Applications, by Bracewell, McGraw Hill

Elementary Partial Differential Equations, by Berg & McGregor

Recommended enrichment texts

Methods of Math Physics, Courant & Hilbert, Wiley.

Advanced Calculus, by R. Creighton Buck, Waveland Pr Inc

Special Functions & Applications, Lebedev & Silverman, Dover paperback

Ordinary Differential Equations, EL Ince, Dover paperback

Complex Analysis, by LV Ahlfors, McGraw Hill

Grading: Homework 50%, Midterm 20%, Final 30%

Exams: One in-class midterm & a final exam, scheduled 10am Thursday Dec 18.

Homework: WORK TOGETHER & GIVE ME WHAT YOU HAVE PROMPTLY.
I will provide solution sets when homework is due; typically on Thursdays.

Pointers

- **Work together on homework – it is better for everyone. Those who already know reinforce their understanding by explaining.**
- **Exams, however, are to be completed independently. Cheating on exams is unacceptable & I would recommend expulsion to the investigating officer.**
- **Failure to complete an exam due to an excused absence will result in the lower of your other grade(s) (hwk, other exam) being substituted for the missed exam. Missing an exam without an excused absence will result in a grade of 0.**

Avail yourselves of all resources for background material, including internet:

- Wikipedia is often good but sometimes terrible
- many MIT courses are available free online at <http://ocw.mit.edu/index.html> You must download the freeware RealPlayer to view. For example, Gil Strang's 1999 linear algebra course features a lecture on the SVD, at <http://web.mit.edu/18.06/www/Video/video-fall-99-new.html>
- some textbooks are legitimately available online; many more are pirated

libraries in Milwaukee:

The University of Wisconsin-Milwaukee (UWM) <http://www.uwm.edu/Library/>
Texts & articles that are not available at UWM can almost always be ordered through the University of Wisconsin (UW) interlibrary loan, which takes a week or more.
Therefore, check local libraries' online catalogs for immediate access.

Marquette University (MU) Raynor & Memorial Library <http://www.mu.edu/library/>
located at 1355 W. Wisconsin Ave downtown

- Often has old texts not available at UWM
- MU's physics department is now undergraduate-only, so advanced texts are almost always available
- UWM students can check out books for 1 month using the INFOpass

Milwaukee Public Library <http://www.mpl.org/>

Located at 814 W. Wisconsin Avenue

- UWM students should be able to get a library card easily – be sure to take a photo ID
- Typically books can be checked out for 3 weeks & renewed online once

Milwaukee School of Engineering (MSOE) <http://www.msOE.edu/library/>

located at 500 E. Kilbourn Avenue downtown

- Collection is not huge, but they have things unavailable elsewhere in town
- UWM students can check out books using the INFOpass (for 1 month, I believe)

The Medical College of Wisconsin <http://www.mcw.edu/display/router.asp?docid=119>

Located at 8701 Watertown Plank Road, Milwaukee, WI 53226, about 12 miles west of

- Collection is devoted to biomedical/medical physics texts & journals
- Librarians are very helpful & have faxed articles to me, saving a trip to the library

You will “lose points” for answering a cell phone in class.