# Physics 502: Math Models of Physical Problems II

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Lectures: 1pm MWF Physics 146
Office Hours: TBD, probably, Mon 2-3:30 and by appointment
Topics: Orthogonal decompositions of functions, eigenspaces of linear operators

- Finite dimensional – quick review of SVD and applications (least squares, matrix exponential for solving ODE systems)
- Infinite dimensional decompositions, primarily in $L^2$
  i. Fourier series
     a. Gibbs ringing
     b. Applications – summations, solve ODE & PDE on bounded domains,
  ii. Fourier transform
     a. Properties – rotation, translation, convolution, autocorrelation, isomorphism
     b. Applications - Hilbert transform, dispersion relations, ODE & PDE on unbounded domains, interpolation & gridding, Heisenberg's inequality, Radon transform & projection-slice theorem
     c. Time- and band-limiting, filtering
  iii. Polynomial decomps – Legendre, assoc Legendre & spherical harmonics, Hermite, (Laguerre, Chebychev, Jacobi, prolate spheriodal *etc time permitting*)
  iv. Fourier-Bessel
  v. Gamma function

Textbooks: *Special Functions and Their Applications*, by NN Lebedev, Dover Recommended
*Linear Algebra & Its Applications*, by Strang, Harcourt-Brace-Jovanovich
*Fourier series and integrals*, by H Dym and HP McKean, Academic Press**R**
*The Fourier Transform and Its Applications,* by Bracewell, McGraw Hill **R**
*Methods of Math Physics*, Courant & Hilbert

Grading:

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| Homework | 50% |
| Midterm | 20% |
| Final | 30% |

Exams: One in-class midterm & a final exam.
Homework: WORK TOGETHER & GIVE ME WHAT YOU HAVE PROMPTLY. I will provide solution sets when homework is due; typically on Wednesdays.