# MAT 342/APC 342: Numerical Methods
# Spring 2012, Syllabus
Tues., Thurs. 11:00 AM - 12:20 PM Fine 214

**Instructor:** Michael Schwemmer, email: mschwemm@princeton.edu, Office: 212 Fine Hall

**Teaching Assistant:** TBA

**Office Hours:** TBD

**General Course Description:** Introduction to numerical methods with emphasis on algorithms, applications and computer implementation issues. Solution of nonlinear equations. Numerical differentiation, integration, and interpolation. Direct and iterative methods for solving linear systems. Numerical solutions of differential equations, two-point boundary value problems. Topics in approximation theory. Lectures are supplemented with numerical examples using MATLAB.

**Textbook:** *Numerical Analysis* by R.L Burden and J.D. Faires, ninth edition.
Recommended and on Reserve in Library:

- *Numerical Analysis: Mathematics and Scientific Computing* by D. Kincaid and W. Cheney
- *Analysis of Numerical Methods* by E. Isaacson and H.B. Keller

**Prerequisites:** MAT 201 and 202, or 203 and 204, or permission of the instructor. This course also involves a fair amount of programming. Students should be somewhat familiar with a coding language such as MATLAB and/or have a strong willingness to learn.

**MATLAB and Math Accounts:** Since MATLAB is the primary programming language that will be utilized there are two ways students can gain access to MATLAB:
1. Obtaining and using a math computing account and working remotely or on the computers in the Fine Hall computer lab. To obtain a math computing account send an email to compudoc@princeton.edu and see the help page at

`http://compudoc.princeton.edu/compudocwiki/index.php/Main_Page`

2. MATLAB can be downloaded onto your own laptop or PC by following the instructions on this page:

`http://www.princeton.edu/software/licenses/software/matlab/`

If you are new to MATLAB, I highly suggest watching the tutorials avaliable here

`http://www.mathworks.com/academia/student_center/tutorials/launchpad.html`

and using the vast resources of the world wide web and/or making an apointment with either myself or the teaching assistant.

**Grading Policy:** There will be six homeworks and a take-home final. The grading scheme will roughly be
Homework: $\approx 60\%$ (10% each)
Final (take-home): $\approx 40$ %

**Homework:** The homeworks will involve both theoretical and computational exercises. While I don't mind if you write-up (neatly) the theoretical portions, the computing portions should be typed up for example using LaTex, Microsoft word, or the Matlab publishing feature. Figures should have clearly labeled axes and should always be accompanied by an explanation. Using the MATLAB publish mode is an acceptable way to turn in your computational homework. For information see:

`http://www.mathworks.com/help/techdoc/matlab_env/f6-14058.html`
`http://www.mathworks.com/videos/matlab/publishing-matlab-code-from-the-editor.html`

and the examples I have posted on the Blackboard site under "Matlab Materials." Also, please do not turn in pages and pages of figures. Use the matlab subplot command to save space, and also try to print things out double-sided if possible. We have to save the trees somehow.

**Tentative Schedule:**

- Numerical Algorithms, Error ($\approx$ 1 week)
- Polynomial Interpolation ($\approx$ 1 week)
- Numerical Differentiation ($\approx$ 1 week)
- Numerical Integration ($\approx$ 2 weeks)
- Approximation of functions, least squares ($\approx$ 1 week)
- Solving Systems of Linear Equations ($\approx$ 2 weeks)
- Solving Nonlinear Systems ($\approx$ 2 weeks)
- Approximating Solutions of Ordinary Differential Equations ($\approx$ 2 weeks)