## Contact Info:
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## Office hours:
Tuesday 10 – 11 am, Wednesday 12:15 – 2:00 pm, and by appointment

## Web Page:
http://www.math.psu.edu/brannick/456/

## Academic Integrity Statement:
All Penn State Policies regarding ethics and honorable behavior apply to this course (see [http://www.psu.edu/ufs/policies/](http://www.psu.edu/ufs/policies/) for the details on Penn State Faculty Senate policies for students).

## Textbook:

## Short description:
Numerical analysis is the study of algorithms for computing numerical answers to mathematical problems (or mathematical models of physical problems). We shall introduce and analyze numerical techniques and algorithms for a variety of basic problems, studying their efficient computer implementation, robustness and reliability. This course is a follow-up to Introduction to Numerical Analysis I. It will provide further introduction to the basics of the modern numerical techniques when applied to problems of analysis and algebra.

## Classroom:
The class will meet in 116 EES.

## Prerequisites:
Introduction to Numerical Analysis I; Single variable calculus; matrix algebra, and a very basic knowledge of computer programming (very little basic knowledge in any of the following computer languages: C, C++, FORTRAN, Java will be sufficient. Matlab or Mathematica may also be used.)

## Grading:
There will be one midterm exam (35%) a final exam worth 35%, and homework assignments (including some computer assignments) worth 30%.

## Homworks:
Homework assignments will be due about every three to four weeks.

## Attendance Policy:
I encourage you to attend every class. In borderline cases, attendance will be taken into consideration.
Course topics

Introduction

* Review of some basic mathematical facts (Taylor formula, etc.)
* Norms of matrices and vectors, inner products, eigenvalues and condition numbers.

Polynomial approximation

* Polynomial approximation. Weierstrass’ approximation theorem.
* Best approximation: Least squares.
* Trigonometric interpolation.
* Fast Fourier Transform. HW1 due on 2/16.

Systems of linear equations

* Basic iterative methods for linear systems.
* Convergence of the basic iterative methods.
* Conjugate gradient method.
* Convergence of the conjugate gradient method. HW2 due on 3/11.

Numerical methods for eigenvalue problems

* Power method.
* Schur and Gershgorin theorems.
* The symmetric and non-symmetric QR algorithm. HW3 due on 3/27.

Numerical solution of ordinary differential equations

* Taylor series methods for ODEs.
* Runge–Kutta methods for ODEs.
* Local and global errors: stability.
* Boundary value problems. Finite differences.
* Variational principle and introduction to finite element method. HW4 due on 4/29.

03-16 Midterm