

**AME 525: Engineering Analysis I**  
**Prof. P.K. Newton, OHE 430D, 740-7782 (newton@usc.edu)**  
**Spring 2023**  
**Time: MW 12:00-1:50, OHE 122**  
**Office Hours: TBA**  
**TA : TBA**

The course will cover techniques from linear algebra, vector analysis, complex variable theory, and partial differential equations.

**Grading:**

- Homework 20 %
- Midterm (TBA) 35 %
- Final (Fri Dec. 9, 2022 11-1pm) 45 %
- No exceptions/extensions will be made on Midterm or Final Exams

**Books:**

**Advanced Engineering Mathematics**, Peter V. O'Neil (Most recent Edition)

**Lecture Outline:**

1. Finite dimensional vector spaces and linear algebra
  - (a) Basic concepts of linear vector spaces
  - (b) Eigenvalues and eigenvectors
  - (c) Solving  $Ax = b$ : The Fredholm alternative
  - (d) Least squares methods
  - (e) Diagonalization and spectral decomposition
  - (f) Singular value decomposition

## 2. Vector analysis

- (a) Line integrals in the plane
- (b) Green's theorem in the plane
- (c) Path independence
- (d) Multiply connected domains
- (e) Line integrals in space
- (f) Gauss' divergence theorem
- (g) Green's identities
- (h) Stokes theorem

## 3. Complex variable theory

- (a) Basic concepts
- (b) Analytic functions and the Cauchy-Riemann equations
- (c)  $x = f(z)$  as a mapping
- (d) Derivatives
- (e) Cauchy-Riemann equations
- (f) Harmonic functions
- (g) Integrals of complex functions
- (h) Contour integrals
- (i) Cauchy-Goursat theorem
- (j) Cauchy integral formula
- (k) Residue theory

## 4. Partial differential equations

- (a) Separation of variables for Laplace's equation in 2D
- (b) Fourier series solutions
- (c) Squares, rectangles, circles