



**THE OHIO STATE UNIVERSITY**  
COLLEGE OF ENGINEERING

# Numerical Methods

## CSE 5361

**Credit Hours:**

3.00

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**Course Levels:**

Undergraduate (1000-5000 level)

Graduate (5000-8000 level)

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**Course Components:**

Lecture

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**Course Description:**

Numerical methods for scientific computation: computer arithmetic, rounding errors, machine precision, machine representation, root-finding, interpolation, integration, linear systems, splines, smoothing, curve-fitting, linear programming.

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**Prerequisites and Co-requisites:**

Prereq: 2231, and Math 2568 (268) or 571, and 1151 (151).

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**Course Goals / Objectives:**

- Master using the bisection method, Newton's method, and the secant method in single variable root finding
  - Master central difference formula and Richardson extrapolation for numerical differentiation
  - Master trapezoid rule, recursive trapezoid formula and Romberg algorithm for numerical integration
  - Master Gaussian elimination with scaled partial pivoting
  - Be competent with using IEEE single precision floating point arithmetic standard
  - Be competent with loss of significant digits in numerical calculations
  - Be competent with polynomial interpolation and Lagrange and Newton form
  - Be competent with numerical computation of second derivative
  - Be familiar with Simpson's and adaptive Simpson's algorithm
  - Be exposed to calculating errors in polynomial interpolation
  - Be exposed to Gaussian quadrature formulas
  - Be exposed to solving linear systems using matrix factorization
  - Be exposed to iterative solutions of linear systems
  - Be exposed to method of least squares
  - Be exposed to Monte Carlo simulation
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**Course Topics:**

- Taylor series
  - Computer arithmetic, rounding errors, machine precision, machine representation
  - Root finding
  - Polynomial interpolation
  - Numerical differentiation and integration
  - Systems of linear equations; Gaussian elimination and iterative methods
  - Monte Carlo Integration
  - Smoothing of data and least squares method
  - Splines
  - Linear Programming
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**Designation:**

Elective