

ME 250
Numerical Methods in Mechanical Engineering
(3 credit hours)

- Objectives**
1. Learn to program in Matlab
 2. Solution of nonlinear equations
 3. Vector analytic geometry and linear algebra
 4. Construction of an interpolation polynomial, a least square fit, and a spline from given data
 5. Construction of finite difference approximations to derivatives and numerical integration
 6. Determination of a numerical solution to linear and nonlinear ordinary differential equations

- Prerequisites**
- Enrollment as Mechanical Engineering major or written permission of Mechanical Engineering department
- Before taking this class, the students should specifically know:
1. Calculus

- Topics**
1. Matlab Programming
 2. Roots of Nonlinear Equations
 3. Solution of Linear Equations by Gaussian Elimination
 4. Interpolation and Function Approximation
 5. Numerical Differentiation and Integration
 6. Ordinary Differential Equations

- Basis of Grading**
1. Midterms
 2. Final
 3. Homework

- MATLAB Programming**
1. Variable Definitions
 2. Arrays operations
 3. Plotting
 4. Script and function files
 5. Conditional statements
 6. Loops

- Roots of Nonlinear Equations**
1. Bisection method
 2. Regula Falsi and secant methods
 3. Newton's method
 4. Fixed point iteration method
 5. MATLAB methods

- Interpolation and Function Approximation**
1. Lagrange interpolation polynomials
 2. Newton interpolation polynomials
 3. Spline interpolation: linear, quadratic, and cubic
 4. Least square: linear, quadratic, and cubic
 5. MATLAB methods

- Numerical Differentiation and Integration**
1. Differentiation: two and three points
 2. Integration: trapezoid, Simpson, and midpoint rules
 3. Composite integration: trapezoid and Simpson
 4. MATLAB methods

- Ordinary Differential Equations**
1. Initial value problems
 2. Taylor methods
 3. Runge-Kutta methods
 4. Boundary value problems
 5. Finite difference method
 6. Shooting method
 7. MATLAB methods