# Numerical Analysis I

**Course prefix:** CX/Math

**Course number:** 4640

**Section:** A, BG, BU, Q

**CRN**
29189 30181 30182 30481

**Instructor first name:** Haesun

**Instructor last name:** Park

**Semester:** Spring

**Academic year:** 2026

**Course description:**

This course introduces the basic numerical methods used in many applications areas in computational science and engineering.

Topics Covered:

- Introduction: Floating point arithmetics, sources of errors
- Systems of Linear Equations: Gaussian elimination, pivoting, norms, condition numbers
- Linear Least Squares: Normal equations method, orthogonalization methods for full rank problems
- Solution of Nonlinear Equations: Bisection and secant methods, fixed point iteration, Newton's method
- Interpolation: Lagrange interpolation, Newton interpolation, Chebyshev polynomials, Hermite interpolation, Splines, Fast Fourier Transformation
- Numerical Differentiation and Integration: Trapezoidal rule, Simpson's rule, Newton-Cotes quadrature, Gaussian quadrature, adaptive quadrature, finite difference, Richardson extrapolation
- Numerical Solutions of Ordinary Differential Equations: initial value problems, systems of equations, Euler method, Runge-Kutta method
- Optimization (if the schedule allows): Existence of solutions, Optimization in one dimension, unconstrained and constrained optimizations, optimality conditions, Newton's method, Steepest descent, Conjugate gradient method

**Academic honesty/integrity statement:**

Students are expected to maintain the highest standards of academic integrity. All work submitted must be original and properly cited. Plagiarism, cheating, or any form of academic dishonesty will result in immediate consequences as outlined in the university's academic integrity policy.