# CSE235
# Numerical Methods

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# Course Introduction

Name: Numerical Methods / Numerical Analysis (Theory Course)

Credit: 3.0

Batch: 61

# Course Contents

**Numbers and Errors:**

Introduction, Accuracy and errors, Significant digits, Absolute and relative error, Rounding error in functional evaluation, Propagation of error in the arithmetic process, and Truncation errors.

**Solution of Non-linear Equation:**

Method of iteration, Bisection method, Newton–Raphson method, False position method, Secant method, Fixed point method.

# Course Contents

**Interpolation:** Difference tables, Newton's forward and backward interpolation formula, Spline interpolation.

**Solution of Linear Equations**: Gaussian elimination, Gaussian elimination by pivoting, LU decomposition, Cholesky method, Triangular systems and back substitution, Gauss-Jordan method, Iteration method of Jacob and Gauss-Seidel.

**Curve fitting:** Linear and polynomial regression, Fitting exponential and Trigonometric functions, Chebyshev polynomial.

**Numerical Integration & Differentiation:** Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Boole's rule, Weddle method and Rhomberg rule with error, Min-Max values of tabulated functions.

**Solution of Ordinary Differential Equations:** Runge-kutta method, Euler and modified Euler's method, Picard's method, Milne's method, Taylor's series methods.

# What is Numerical Analysis

- Numerical methods **provide a way to solve problems quickly and easily compared to analytic solutions**.

- What is analytical solution?? What is difference between analytical solution vs numerical solution ??

# Why Numerical Analysis ??

- Computing integrals and derivatives
- Solving differential equations
- Building models based on data, be it through interpolation, Least Square, or other methods
- Root finding and numerical optimization
- Estimating the solution to a set of linear and nonlinear equations
- Computational geometry

# Why Numerical Analysis for CSE engineers??

- Development and computation of optimal control algorithms
- Machine learning algorithms, like estimating optimal weights of parametric models using only subsets of the full dataset (like stochastic gradient descent)
- Filtering of noisy data based on an approximately expected machine learning model.

# Be Careful!!

- Numerical analysis is typically hard course but I will try to make it easy if you all are cooperative with me.

Thank you