



## Numerical Analysis (1)

Course Code	Course Num.	Course Name	Credit Hours	Lec	Lab	Tut	Prerequisites
MAT	333	Numerical Analysis (1)	4	3	2	1	MAT 231, MAT223

### *Objectives:*

This course provides an introduction of computational techniques for finding approximate solutions to difficult mathematical problems. Theory and practice approaches are taught. The error sources and the convergence of the algorithms will be estimated with respect to the various techniques used. The course will involve the use of Matlab or C++ in Lab.

### *Syllabus:*

- **Introduction to data representation:** Numerical Errors; Floating Point Representation; Round-off; Significant Digit; Error Propagation.
- **Root Finding:** Bisection Method, Newton's Method, Secant Method, Fixed Point Iterations.
- **Interpolation and Approximation:** Taylor polynomials, Approximation of order n, Polynomial Error, Linear and Quadratic Interpolation, Lagrange Interpolation, Newton Divided Difference Method, Error Evaluation, Spline Interpolation.
- **Numerical Integration and Differentiation:** The Trapezoidal and Simpson Rules, Gaussian Quadrature, Numerical Differentiation.
- **Numerical Solution of Linear Systems:** Gauss Elimination, LU and Cholesky Decompositions, Iterative Methods: Jacobi and Gauss-Siedel Methods, Error Analysis
- **Numerical solution of differential equations:** Euler method, Runge-Kutta methods. Error and convergence analysis.

### *References:*

- **Elementary Numerical Analysis, 3<sup>rd</sup> Edition**, Kendall Atkinson; Weimin Han; (2004).
- **An Introduction to Numerical methods and Analysis**, James F. Epperson, Wiley; (2002).
- **Numerical Analysis**, R. Burden and J. Faires, 8th ed., Brooks/Cole, 2001.

