Learning Objectives (partial): Students will be able to:

1. Define errors in numerical analysis; define discretization error and compare to round-off errors in computing; Construct floating point representation and relate to precision; connect it to round-off errors;
2. Roughly identify computational complexity of algorithms via O(.) notation
3. Define condition number of a matrix and describe its utility in assessing conditioning of a given problem such as solution of a linear system of equations
4. Construct an iterative solution to find the zeros of a nonlinear equation through techniques such as Fixed Point Iteration, Newton's method, Secant method; describe its connection to optimization; analyze convergence of iterative methods
5. Construct algorithms for solution of linear system of equations through both Gaussian elimination, forward/backward substitution, and LU decomposition; define their complexities; describe the advantage of LU decomposition in solution of linear systems
6. Formulate a linear least squares problem to solve an overdetermined system of equations; derive its solution via normal equations ; apply to data fitting problems
7. Construct the spectral decomposition (Eigen Value Decomposition-EVD) and Singular Value Decomposition (SVD) of matrices, and truncated SVD. Describe and use Power method to estimate the dominant eigen value/vector of a given matrix; Apply eigen (singular) value /vector and truncated SVD methods to real life problems;
8. Describe principles of data interpolation and approximation; Expand the interpolating/approximating function over a set of basis functions; construct polynomial interpolation solution using different polynomial bases such as monomial, Lagrange, Newton polynomials; apply those to real problems
9. Implement the above concepts in a programming environment (such as MATLAB)