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Dated: 30 October, 2022.

**Applied Numerical Linear Algebra**

**Syllabus of Math-505**

**System of linear equations-** Introduction, Special matrices, Solving linear systems, Direct methods (Crammer’s Rule, Gaussian Elimination methods, LU-decomposition methods (Direct and indirect factorization)), Norms (natural and other) of a vector and a matrix, Indirect methods (Jacobi iterative method, Gauss-Seidel method, SOR method), Error in solving linear systems, conditioning (well-behaved and ill-condtioning) of the linear systems, solving ill-conditioning systems, (Residual Corrector method), Some applications.

**Eigenvalue problems-** Introduction, finding eigenvalues and eigenvectors of the nonsymmetric and symmetric matrices, properties of eigenvalue problems, similar matrices, diagonalization matrices and orthogonally diagonalization matrices, Solving eigenvalue problems using direct and indirect methods, some numerical methods Power methods(simple, inverse and shifted inverse rules), Methods for symmetric matrices (Jacobi method, Given method, Householder’s method) and matrix decomposition methods (QR method, LR method, and Singular Value Decomposition method).

**Approximation of function-** Introduction, approximation of a function using polynomials and Lease squares approximation (linear and nonlinear), Least squares solution of over-determinant and under-determinant linear systems.

**Software Used:** Solving problems using numerical methods with the help of **MATLAB.**

**Name of Instructor: Dr. Rizwan Butt**

**References:**  Textbook: An Introduction to Applied Numerical Linear Algebra using MATLAB, by Dr. Rizwan Butt, Alpha Science International Ltd., UK, 2015.

An Introduction to Numerical Analysis, by R.L. Burden and J.D. Faires, PWS-Kent Publishing Company, 2001.

An Introduction to Numerical Analysis Using MATLAB, by Dr. Rizwan Butt, Jones and Bartlett publishers, USA, 2009.

**Methods of Evaluation:** Short quizzes, Two Midterm exams, Homework and Computer assignments, short talk using specific topic of the course, Final Exam.

**Dr. Rizwan Butt**