MATH6025: Numerical Linear Algebra
Preliminary Syllabus (graduate course)

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Office Hours: Mondays: 4:00 - 5:30 pm, in Room 407G.

- **Main Reference Book**: Yousef saad, "Iterative Methods for Linear Systems", Second Edition with Correction, January 3, 2000.

- **Prerequisites:** Calculus, Linear Algebra, Elements of Graph Theory

- **Expected Work:** Homework/quizes (1/3); Midterm and Final Project (2/3).

- **Topics:**

    1. *Backgrounds in Linear Algebra*: Vector Inner Products and Norms; Canonical Forms of Matrices; Normal and Hermitian Matrices; Positive Definite Matrices (symmetric and non-symmetric) Nonnegative Matrices; M-Matrices; Matlab Exercises*

    2. *Special Matrices*: Graph Representations; Special Matrices and Their Properties; Matlab Exercises*;

    3. *Iterative Methods*: Jacobi, Gauss-Sedel, and SOR; Convergence; Direct Methods; Matlab Excercises*;

    4. *Preconditioning Iterations*: Definition and Examples; Conjugated Gradients; Preconditioned GMRES; Matlab Excercises*

    5. *Preconditioning Techniques*: Jacobi, SOR and SSOR Preconditioners; Matlab Excercises*

    6. *Domain Decomposition Methods*: Direct Solutions and Schur Complement; Schwardz Alternating Prcedures; Graph Partitioning

    7. *Eigenvalues, Eigenvectors and Singular Values*: Hermitian and Non-Herimitian Matrices, Singular Values;

    8. *More on Numerical Linear Algebra:*

- **References:**

    1. G. Golub and C. Van Loan,"Matrix Computations", Third Edition

    2. R. Horn and C. Johnson, "Matrix Analysis", Cambridge University, 1994

    3. "Scientific Computing, An Introductory Survey", 2nd Edition, M. T. Heath, McGraw-Hill, 2002