CL 652 Computational Techniques in Control Engineering

List of Projects @ 40% weightage in the assessment

1. Iterative methods for solving Linear System of Equations, with
   a. Error analysis
   b. Applications to Recursive Least Squares problems and Kalman Filter
2. A complete document on floating point arithmetic, with
   a. Software issues
   b. IEEE standards
3. Fast matrix multiplication methods, with
   a. Error analysis
   b. Applications to matrices arising in machine learning and modern massive data sets (MMDS)
4. Conjugate Gradient methods, with
   a. Error analysis
   b. Applications to Neural Network Training algorithms
5. A complete document on computing eigenvectors
   a. Including the case of algebraic multiplicity
   b. Comment on the accuracy of the results
6. QR decomposition, with
   a. A self-sufficient tutorial, including Householder and Hessenberg algorithms, and shifts
   b. Computational complexity, and Numerical accuracy
7. Computing the state solution x(t), say for step input
   a. Padé's Algorithm and RSD, comparison with MATLAB's *expm(A)*
   b. Matrices of size at least 10 x 10
8. Numerically effective tests for
   a. Controllability and Observability
   b. Distance to Uncontrollability
9. Design of State-feedback control
   a. Single-Input case and Multi-Input case
   b. Computational complexity
10. Comparison of various methods for
    a. Lyapunov test
    b. Both continuous- and discrete-time cases
11. Large-scale matrix computations in control
    a. Lanczos methods
    b. Krylov subspace methods
12. Linear algebraic methods in rating systems
    a. Massey and Colley methods
    b. Google's Pagerank
13. A tutorial on Quaternions, extension of linear algebra for modeling dynamical systems.