Cal State LA Department of Mathematics
Syllabus for MS Comprehensive Examinations
NUMERICAL ANALYSIS

1. Numerical Linear Algebra
   i) Direct solution of linear systems: Positive definite matrices and Cholesky Factorization, LU decomposition; Gaussian elimination with pivoting and Gauss-Jordan elimination, operation counts, round-off error.
   ii) Iterative solution of linear systems: Jacobi, Gauss-Seidel, and SOR iteration; convergence of general iterative methods.
   iii) Eigenvalue/eigenvector problems: the power method, inverse power method and Rayleigh Quotient technique; the QR method; convergence considerations and orders of these methods.
   iv) Relevant theoretical considerations: Properties of matrices including norms and condition number, eigenvalue, eigenvectors, null-space, column space, rank, similarity transformations, and Gram-Schmidt orthogonalization.

REFERENCES

- Pre-requisite Math 470 textbook: Epperson, J., An Introduction to Numerical Methods and Analysis, 2nd edition

2. Numerical Solution of PDEs
   i) Parabolic equations: finite-difference approximations, explicit and implicit methods, consistency, stability, convergence.
   ii) Hyperbolic equations: finite-difference approximations, explicit and implicit methods, the method of characteristics and numerical integration for first and second order; the CFL condition; consistency, stability, convergence.
   iii) Elliptic equations: existence and uniqueness of solutions, Maximum principles, finite-difference approximations, consistency and convergence.

REFERENCES

- Pre-requisite Math 470 textbook: Epperson, J., An Introduction to Numerical Methods and Analysis, 2nd edition