MAT661 - Topics

(1) Linear Systems
(2) Augmented Matrix
(3) Identity Matrix
(4) Inverse of Matrix
(5) Eigenvector, Eigenvalue
(6) Sparse Matrices, Tridiagonal Matrix
(7) First Difference - 3-point-central
(8) Second Difference - 3-point-central
(9) "Favourite Tridiagonal Matrix" - negative second derivative operator
(10) Boundary Value Problem - Eigenfunctions
(11) Invertibility Theorem - LONG, Growing List
(12) Determinants
(13) Liner Transformations: Rank, Nullity, Kernal, Null Space, Range, Etc.
(14) Orthogonal Projections
(15) Gram-Schmidt Orthogonalization Process
(16) Diagonalization
(17) Tridiagonal Algorithm
(18) Iterative System Solvers: Gauss-Sidel / Jacobi
(19) Fixed Points: Definition, Existence, Uniqueness, Convergence
(20) Newton's Method: $f : \mathbb{R} \to \mathbb{R}$, $f : \mathbb{R}^n \to \mathbb{R}^n$
(21) Multivariable functions: Directional Derivatives, Derivatives, Second Derivatives, Gradients, Jacobians, Hessians.
(22) Vector spaces, L^2, inner products, Projections on to Subspaces
(23) Fourier series, Fourier coefficients
(24) ODE Techniques: Integrating Factors, Sep. of Vars, Constant Coeff
(25) ODE Systems: Eigenvalues, Char. of Equilib. solutions, Nonlinear Systems
(26) Eulers, Runge-Kutta, Finite Differences
(27) Vector Fields, Phase Diagrams
(28) Linear/Nonlinear Pendulum, Mass-Spring system
(29) ODE Existence/Uniqueness Theorems
(30) Successive Approximations
(31) First Order PDE - Transport Equation - Traveling Waves, Shocks
(32) Heat (Parabolic) Equation - Inititial and Boundary Conditions, Model, Exact Solution via Separation of Variables
(33) Laplace's (Linear Elliptic) Equation
(34) Wave (Hyperbolic) Equation
(35) Explicit/Implicit Method, Method of Lines
(36) Gauss-Sidel / Banded Solver for multiple space variable discretized systems