

EECS 16A Spring 2026 by week, grouped by topic

Week 0: Vectors & Signals

- ~~Complex numbers~~
 - ◉ ~~Plotting on the complex plane (Note i Ex. 1; Dis 0B)~~
 - ◉ ~~Magnitude and phase (Note i)~~
 - ◉ ~~Euler's formula (Note i)~~
 - ◉ ~~Rectangular $\leftrightarrow$ polar conversion (Note i)~~
 - ◉ ~~Multiplication and division in polar form (Note i)~~

Week 1: Vector Spaces, Inner Products · Cauchy-Schwarz, Triangle Inequality

- Signals
 - ◉ Special signals: step, ramp, pulse, delta; continuous vs. discrete (Dis 1A Q1)
 - ◉ ~~Even and odd signals (Dis 1A Q1)~~
 - ◉ Signals as vectors: adding and scaling (Dis 1A Q2)
- ~~Vector spaces~~
 - ◉ ~~Vector space definition (N1 1.1)~~
 - ◉ ~~Subspaces (N1 1.2)~~
 - ◉ ~~Cartesian and polynomial spaces (N1 1.3; Dis 1B Q1)~~
 - ◉ ~~Bases and dimension (N1 1.4)~~
- Inner products
 - ◉ Dot product (*simplified: multiply-and-add*) (Dis 1A Q3)
 - ◉ ~~Inner product axioms (Dis 1A Q3)~~
 - ◉ Cauchy-Schwarz (*simplified: bounded similarity, no proof*) (Dis 1B Q2)
 - ◉ ~~Triangle inequality (lecture only)~~

Week 2: Periodicity, Complex Exponentials · Euler's Formula

- ~~Proofs and linear dependence~~
 - ◉ ~~Proof techniques: direct, constructive, contradiction (N2)~~
 - ◉ ~~Span and span proofs (Dis 2A Q1-Q2)~~
 - ◉ ~~Dimension and linear independence (Dis 2A Q3)~~
 - ◉ ~~Dependent columns $\Rightarrow$ zero or infinitely many solutions (N2 Thm. 2.1)~~
- ~~Complex exponentials~~
 - ◉ ~~cos and sin as complex exponentials (Dis 2B Q1)~~
 - ◉ ~~De Moivre's theorem (Dis 2B Q1)~~
 - ◉ ~~Discrete complex exponentials and periodicity (Dis 2B Q3)~~
- Orthogonality
 - ◉ Orthogonal vectors (*simplified: dot product of zero*) (Dis 2B Q2)
 - ◉ ~~Orthonormal bases, 4 point Fourier vectors (Dis 2B Q2)~~

Week 3: DTFS

- Periodic signals

- Fundamental period and frequency (N3 3.1.1)
- ~~Periodic signals as vectors in $\mathbb{C}^N$ (N3 3.1.1)~~
- ~~Fourier basis~~
 - ~~DTFS Fourier basis (N3 3.1.2)~~
 - ~~Converting to the Fourier basis (N3 3.1.3)~~
 - ~~Orthogonality proof (N3 3.1.4; Dis 3A)~~
 - ~~Validity of the basis (N3 3.1.5)~~
- DTFS
 - Signals as sums of sines (*simplified: no formulas*) (N3 3.1.6; Dis 3B Q1)
 - ~~DTFS and inverse DTFS formulas (N3 3.1.6; Dis 3B Q2)~~
 - ~~DTFS properties (Dis 3B Q3)~~

Week 4: DTFS (continued)

- DTFS
 - ~~DTFS properties and puzzle (Dis 4A)~~
 - Frequency interpretation (N3 3.1.7)
- DFT
 - DFT/FFT (*simplified: tool only*) (N3 3.1.8)
 - ~~DTFS vs. DFT analysis (Dis 4B)~~
- ~~Applications~~
 - ~~Fourier family: DTFT, CTFS, CTFT (N3 3.1.9)~~
 - ~~Image compression (N3 3.1.9)~~

Week 5: Least Squares

- ~~Orthogonalization~~
 - ~~Gram-Schmidt (Dis 5A)~~
 - ~~QR decomposition (Dis 5B Q1; VMLS 12.3)~~
 - ~~Matrix inverses (Dis 5B Q2)~~
- Least squares
 - Least squares problem (*simplified: best fit plus library call*) (VMLS 12.1; Dis 5B Q3)
 - ~~Normal equations, pseudo-inverse (VMLS 12.2)~~
 - ~~Solving via QR (VMLS 12.3)~~
 - Examples (VMLS 12.4)
 - Localization (*simplified: worked example only; APS lab idea*) (Lab: APS)
- Data fitting
 - Fitting univariate functions (VMLS 13.1.1)
 - Regression (VMLS 13.1.2)
 - ~~Log transform (VMLS 13.1.3)~~
 - Validation (VMLS 13.2)
 - ~~Feature engineering (VMLS 13.3)~~

Week 6: Adjacency Matrices, PageRank

- ~~Least squares (continued)~~
 - ~~Least squares with orthogonal columns (Dis 6A Q1)~~
 - ~~Least squares classifier (VMLS 14.1–14.2; Dis 6A Q2)~~
 - ~~Multi-class classifiers (VMLS 14.3)~~
- Matrices
 - Matrix-vector multiplication (N4 4.1)
 - ~~Special matrices: symmetric, skew-symmetric, Toeplitz (N4 4.2)~~
- ~~Graphs and state transitions~~
 - ~~Adjacency matrices (Dis 6B Q1)~~ (Can add back depending on class progress)
 - ~~Reservoirs and pumps (N4 4.5; Dis 6B Q2)~~
 - ~~PageRank: random surfer model, $x[n+1] = Px[n]$ (N4 4.6)~~ (Can add back depending on class progress)

Week 7: Eigenanalysis

- ~~Eigenvalues and eigenvectors~~
 - ~~Eigenvectors (*simplified: stretch directions*) (Dis 7A)~~
 - ~~Computing eigenvalues by hand (Dis 7A Q1)~~
 - ~~Eigenvalues of special matrices (Dis 7A Q2)~~
 - ~~Reservoir eigenanalysis (Dis 7A Q3)~~
- ~~Diagonalization~~
 - ~~Eigendecomposition (N4 4.3)~~
 - ~~Powers of diagonalizable matrices (N4 4.4)~~
- ~~Steady states~~
 - ~~Steady state (*simplified: by iteration*) (N4 4.7; Dis 7B Q1)~~ (Can add back depending on class progress)
 - ~~Column stochastic matrices, eigenvalue 1 (N4 4.7)~~
- ~~Change of basis~~
 - ~~Coordinate transformations (Dis 7B Q2)~~

Week 8: Change of Basis

- ~~Change of basis, "Hide and Seek" (Dis 8A Q2)~~
- ~~Diagonalization (Dis 8A Q1)~~
- ~~State space and controllability~~
 - ~~Cart-pole model $x[n+1] = Ax[n] + Bu[n]$ (Dis 8B)~~
 - ~~Reachability in N steps (Dis 8B)~~

Week 9: Spring Break

Week 10: Intro to SVD · SVD/PCA

- ~~State space (continued)~~
 - ~~Controllability (Dis 9A Q1)~~
- ~~SVD~~

- ~~○ SVD (simplified: "main directions," computed with a library) (N5)~~
- ~~○ Full, compact, and outer product forms (N5 Defs. 5.1–5.3)~~
- ~~○ Finding each form (N5; Dis 9B Q2)~~
- ~~○ SVD and fundamental subspaces (N5 Thm. 5.1; Dis 9B Q1)~~
- ~~○ Geometric interpretation: rotate, stretch, rotate (N5; Dis 9A Q2)~~
- ~~○ Proofs (N5)~~

Week 11: SVD/PCA · DT-LTI Systems

- ~~PCA (Can add back depending on class progress)~~
 - ~~○ Motivation (N6)~~
 - ~~○ Centering and projecting (simplified) (N6)~~
 - ~~○ Denoising and dimensionality reduction (N6)~~
 - ~~○ Choosing the number of components (N6)~~
 - ~~○ Applications: classification, robotic grasping (Dis 10A)~~
 - ~~○ Proof of Theorem 6.1 (N6)~~
- ~~Pseudoinverses~~
 - ~~○ Pseudoinverses (Dis 10B)~~
- LTI systems
 - Linearity and time invariance (N7 7.1)

Week 12: Input-Output Models of DT-LTI Systems

- Impulse response
 - Impulse response as a complete descriptor (N7 7.1.1)
 - ~~○ Difference equations (N7 7.1.2)~~
- Convolution
 - Convolution (simplified: sliding weighted sum) (N7 7.2.1; Dis 11A Q2)
 - ~~○ Convolution properties (N7 7.2.2)~~
 - Examples: pulses, accumulator, ramp (simplified) (N7 7.2.3)
- Filters
 - Filters (Dis 11A Q1)
 - ~~○ Second order trend filter (Dis 11B)~~

Week 13: DT-LTI Systems · State-Space Formulation

- Frequency response
 - Magnitude (simplified: which frequencies pass) (N7 7.3.1–7.3.2)
 - ~~○ Phase and linear phase (N7 7.3.2)~~
 - ~~○ From a block diagram (Dis 12A Q1)~~
 - ~~○ Polynomial multiplication as convolution (Dis 12A Q2)~~
 - ~~○ Circular convolution, zero padding, overlap add/save (N7 7.3.3)~~
- Stability and periodicity
 - BIBO stability (simplified: one-minute aside) (Dis 12B Q1)
 - ~~○ DT periodicity and LTI properties (Dis 12B Q2)~~

- ~~State space formulation (lecture only)~~

Week 14: CT-LTI Systems · Demos and Applications

- ~~CT LTI overview (N8-8.1)~~
- ~~Dirac delta: sampling and sifting (N8-8.2; Dis-13A Q2)~~
- ~~CT LTI systems (N8-8.2.1)~~
- ~~Convolution integral and visual convolution (N8-8.3-8.4)~~
- ~~CT frequency response (N8-8.5)~~
- ~~Review problems: two-tap filter, "Broken Receiver" (Dis-13A Q1; Dis-13B)~~
- Demos and applications (lecture)