

ECE 311: Linear Systems I

IN

OUT

Calculus (MATH 160, 161)

- Can integrate and differentiate.
- Understands fundamental theorem of calculus.
- Has command of trigonometry.

Complex Arithmetic (ECE 202)

- Understands fundamentals of complex arithmetic.
- Can apply Euler's identity.

ODEs (MATH 340/345)

- Able to solve linear ordinary differential equations.
- Can identify homogenous and particular solutions to an ODE.

RLC and Op AMP (ECE 202)

- Can analyze n^{th} order R,L,C and Op Amp circuits and create a corresponding ordinary differential equation.

Pre-requisites:

- ECE202 and MATH340 or MATH345

Concepts:

- Continuous time test signals including:
 - Impulses
 - Steps
 - Exponentials
 - Sinusoids
- Properties of LTI systems (linearity, causality, stability, time-invariance, etc.).
- Representation of Linear, Time-Invariant (LTI) systems in terms of convolution integral and impulse response.
- Interconnection of LTI systems.
- Fourier Series of periodic signals.
- Fourier Transform for aperiodic signals.
- Connection between transfer functions, poles and zeros, impulse response, complex frequency response, ordinary differential equations, and solutions.
- Computation of energy/power spectral density.
- * Correlation.

Applications:

- Communications
- Filtering
- Signal Processing
- Control Systems
- Circuits

Tools:

- MATLAB

LTI Systems

- Understands linearity, causality, stability, and time-invariance.
- Understands interplay between time and frequency domain analysis of LTI systems:
 - Impulse response and convolution
 - Complex frequency response and sinusoidal response
 - Bandwidth and time constant

ODEs and Transfer Functions

- Understands connection between transfer functions, poles and zeroes, impulse response, complex frequency response, and ODE.
- * Can design filters to meet specifications.

Block Diagrams

- Can determine transfer function of a system built of other interconnected linear systems.

Fourier Analysis

- Can analyze spectral components of inputs and outputs of systems.
- Can compute Fourier transforms and series for standard signals.

Simulation

- Can analyze systems in time and frequency domain using MATLAB and/or Simulink tools.

ODE and Op-Amps

- * Can design an Op-Amp circuit from an ODE or frequency response specification.

* = Optional

As of 12/9/08