ECE 202: Circuit Theory Applications

IN

Differential and Integral Calculus

- Integrate and differentiate simple sinusoidal, exponential, and logarithmic functions

Complex Numbers Algebra

- Apply rules and hand-calculate with complex numbers in rectangular, polar, and trigonometric forms

DC Circuit Analysis

- Solve circuits using:
  - Nodal and mesh analysis
  - Linearity property
  - Superposition theorem
  - Source transformation

First and Second Order RLC

- Analyze source-free RL, RC, and RLC circuits
- Calculate step response of RL, RC, and RLC circuits
- Understands general second order circuits

Pre-requisites

- ECE 103 with a minimum grade of C

Concepts:

- Differential and characteristic equations and roots
- Phasor representation of current and voltage
- Equivalence between time and frequency domain
- Sinusoidal steady-state analysis
- Instantaneous and average power
- Effective (RMS) values
- Apparent power
- Power factor
- Complex Power
- Balanced three-phase circuits
- Magnetic flux and transformers
- Linear, ideal, and autotransformers
- Resonances
- System transfer function
- Filters
- Laplace Transform

Applications:

- Design of passive and active filters
- Design of phase shifters
- Power factor correction
- Filter design
- Resonant circuit design

Tools:

- MATLAB
- Cadence

OUT

First and Second Order RLC

- Understand operation of first and second order circuits
- Derive characteristic equation, determine type of response and find total response of a circuit

AC Circuit Analysis

- Use mesh and node analysis to analyze circuits with independent and dependent sources
- Apply superposition, source transformation, Thevenin and Norton theorems

AC Power Analysis

- Calculate instantaneous and average power
- Understand the difference between maximum and RMS value and can apply correct formulas
- Understand principles of power factor correction
- Use PQS triangle

Three Phase Circuits

- Knows configuration of three-phase circuits
- Apply formulas for balanced connections

Frequency Response and Filters

- Calculate transfer function and phase shift
- Express transfer function in Bode format and draw Bode plots
- Understand Decibel scale

Filter Analysis

- Knows configuration of three-phase circuits
- Apply formulas for balanced connections

Transfer Function

- Understand Laplace transform
- Understand Bode plots
- Understand complex response

Reviewed 2/2024