ECE 202: Circuit Theory Applications

IN

Differential and Integral Calculus

- Can integrate and differentiate simple sinusoidal, exponential, and logarithmic functions

Complex Numbers Algebra

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

DC Circuit Analysis

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

First and second order RLC

- Can analyze source-free RL, RC, and RLC circuits
- Can calculate step response of RL, RC, and RLC circuits
- Understands general second order circuits

Pre-requisites:

- ECE103

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:

- Cadence
- MATLAB

OUT

First and second order RLC

- Understands operation of first and second order circuits
- Can derive characteristic equation , determine type of response and find total response of a circuit

AC Circuit Analysis

- Can use mesh and node analysis to analyze circuits with independent and dependent sources
- Can apply superposition, source transformation, Thevenin and Norton theorems

AC Power Analysis

- Can calculate instantaneous and average power
- Understands the difference between maximum and RMS value and can apply correct formulas
- Understands principles of power factor correction
- Can use PQS triangle

Three Phase Circuits

- Knows configuration of three-phase circuits
- Can apply formulas for balanced connections

Frequency Response and Filters

- Can calculate transfer function and phase shift
- Can express transfer function in Bode format and draw Bode plots
- Understands Decibel scale

Filter Analysis

- Can calculate transfer function, cutoff and center frequency, bandwidth, quality factor
- Can perform magnitude and frequency scaling of a given filter

Transfer Function

- Laplace transform
- Bode plots
- Complex response

As of 3/11/13