ECE 331: Electronics Principles

IN

Differential and Integral Calculus
- Can integrate and differentiate sinusoidal, exponential and logarithmic functions
- Can compute terms of a series expansion
- Can evaluate functions at limiting values

Phasors, Impedance
- Can convert complex numbers from Cartesian-to-polar coordinates
- Can convert linear, time-invariant system from differential to transform form

Kirchhoff's Law
- Can analyze circuits with reactive and resistive elements
- Can use mesh and node analysis to analyze circuits with independent and dependent sources

Thevenin and Norton Equivalent Circuits
- Can transform sources and impedances to equivalent forms to analyze circuit behavior

Introductory lab and measurement procedures
- Can use instruments
- Can measure voltage, current and frequency response in RLC circuits
- Can maintain a lab notebook

Bode plot nomenclature and conventions
- Can express transfer functions of single and multiple time constant circuits in Bode format

pSPICE simulation
- Can simulate circuits
- Proficient with sweeps, manipulation of variables and math function capability of simulation tools

Pre-requisites:
- ECE202 and MATH340 or MATH345

As of 12/9/08

Concepts:
- Asymmetric, non-linear devices are modeled in terms of region of operation, and parasitic properties:
  - pn junction diodes
  - Zener diodes
  - Enhancement MOSFETs
  - Bipolar junction transistors
- Region of operation and bias for best performance.
- Transfer functions
- Equivalent circuits
- Common source and common emitter configurations

Applications:
- Voltage, current and power supply design
- Large-signal processing (clamps, logic inverters)
- Linear signal processing (linear amplifiers, filters)

Tools:
- pSPICE

OUT

Analysis and design using models
- Can express diode, MOSFET and BJT regions of operation by function and bias

Device behavior in circuits
- Can determine region of operation, bias points
- Can determine equivalent circuits for any region

Linear Signal amplification, transfer functions, frequency response
- Can depict common gate, drain, and source configurations
- Can analyze circuits for transfer functions of voltage, current and transconductance
- Can determine 2nd harmonic distortion for single stage amplifiers with sinusoid inputs

Parasitic and secondary effects on signal processing
- Can derive full expression for CS or CE configuration frequency response
- Can show relationship to open-circuit time constant and Miller effect approximation

pSPICE simulation
- Can simulate circuits
- Can use simulation to confirm hand calculations for rectifier, single stage amplifiers, and simple inverters
- Able to edit pSPICE models so that models match measurements

Laboratory procedures: measurement, analysis, and reporting
- Can connect devices and evaluate bias circuits and time-varying behavior
- Can analyze measurements and display results in Bode plots for transfer functions
- Can extract device properties (e.g. threshold voltage) from measured data
- Can use LabView to derive I-V characteristics of devices and customize Vi's for processing laboratory information