**COEN 2020 Electric Circuits 2**

**Class schedule:** 3 credit course, meeting for 3 50-minute periods each week.

**Course coordinator:** Dr. Nathan Weise

**Course materials:** James W. Nilsson and Susan A. Riedel, Electric Circuits, 10th. ed., Prentice-Hall, Englewood Cliffs, NJ, 2011, bundled with Mastering Electric Circuits web access

**Catalog description:** Sinusoidal steady-state analysis. Power in AC circuits. Linear and ideal transformers. Laplace transform methods and circuit analysis applications. Passive and active frequency-selective circuits. Fourier methods. Overview of discrete-time analysis.

**Prerequisites:**  EECE 2010 Electric Circuits 1 with minimum grade of C.

**Required course**

**Professional component:** Engineering science – 100%

**Course Goals:**

* Introduce AC steady state circuit analysis techniques.
* Introduce AC steady state power calculation methods.
* Introduce *three phase* power systems and define *balanced* and *unbalanced* systems
* Review inductance and introduce the concept of mutual inductance. Use mutual inductance to define and analyze linear and ideal transformers.
* Introduce the Laplace transform as a general tool for circuit analysis. Use the Laplace transform to solve various DC, AC, and transient circuit problems.
* Introduce the concept of a transfer function and its relationship to the unit-impulse response of a system.
* Introduce convolution as it is used to analyze circuits, including graphical representation of convolution.
* Introduce the ideas of frequency selective circuits as applied to the analysis and design of high-pass, low-pass, band-pass, and notch or band-reject filters.

**Specific outcomes of instruction***By the end of this course, students should:*

1. Be able to describe the electrical characteristics of voltage sources, current sources, resistors, inductors, and capacitors under AC steady state conditions.
2. Be able to apply Kirchhoff’s circuit laws for AC circuits.
3. Be able to apply standard circuit analysis techniques to AC circuits including the methods of node-voltages, mesh-currents, source transformations, Thevenin and Norton conversions, maximum power transfer, superposition.
4. Be able to calculate the average, reactive, and complex power being delivered to or by a circuit element and the power factor.
5. Be able to determine the conditions for maximum power transfer.
6. Be able to define self and mutual inductance. Be able to determine the sign of the induced voltage from either the DOT convention or a physical description of the coils.
7. Be able to analyze circuits containing mutual inductors and to apply special case expressions to ideal transformers.
8. Be able to use the Laplace integral to find the transform of common signals and use tables of Laplace transforms and their properties to determine the transform of other functions.
9. Apply the Laplace transform technique to circuit analysis including the methods of partial fraction expansion and inverse transform techniques.
10. Have an understanding of the transfer function and how its pole and zero locations determine the overall behavior of the associated circuit.
11. Be able to apply convolution techniques, both analytical and graphical, to analyze circuits.
12. Be able to apply knowledge of the frequency dependence of circuit components to determine the general frequency behavior of frequency selective circuits. Be able to identify common low-, high-, band-, and notch-filters. Know the method of determining the cut-off frequencies of various filters.
13. Understand the representation of sampled signals and be able to identify the errors introduced by the sampling process.
14. Be able to represent signals using Fourier series and use Fourier transform techniques to analyze circuits.

**Student outcomes addressed by the course:**Partial fulfillment of Criterion 3 objectives A, E, G, I, and K

**Brief list of topics to be covered**

Sinusoidal Steady-State Analysis Review (9.1 – 9.9)

Power in AC Circuits (Ch 10)

Transformers (6.4, 9.10 – 9.11)

Laplace Methods (Ch 12, 13.1 – 13.5)

Passive and Active Filter Circuits (Ch 14, Ch 15)

Three-phase Power (Ch 11)

Last modified: January 24, 2018