Montgomery County Community College
EGR 214
Linear Electrical Systems II
4-3-3

COURSE DESCRIPTION:
This course introduces the concepts of linear systems theory as applied to electrical networks, AC steady state analysis, frequency response, two-port models, Fourier series, and Laplace transforms. This course is subject to a course fee. Refer to http://mc3.edu/adm-fin-aid/paying/tuition/course-fees for current rates.

REQUISITES:
Previous Course Requirements
- EGR 211 Linear Electrical Systems I
- MAT 201 Calculus II
- PHY152 Principles of Physics II

Concurrent Course Requirements
None

LEARNING OUTCOMES Upon successful completion of this course, the student will be able to:	LEARNING ACTIVITIES	EVALUATION METHODS
1. Calculate instantaneous, average, real, reactive, and maximum transferred (load) power, as well as RMS and effective signal strength and power factor in simple series and parallel AC circuits.	Lecture Problem Solving Assignments Design of Experiments	Section Examination Design of Experiments Review
2. Apply the concepts of mutual inductance, coefficient of coupling, and turns ratio to calculate voltages and currents in AC circuits containing mutual inductance.	Lecture Problem-Solving Assignments Design of Experiments	Section Examination Design of Experiments Review

LEARNING OUTCOMES	LEARNING ACTIVITIES	EVALUATION METHODS
3. Examine the characteristics of a balanced, three-phase circuit, including basic wye and delta three-phase connections, in order to calculate voltage, current, and complex power in the same.	Lecture Problem-Solving Assignments Design of Experiments	Section Examination Design of Experiments Review
4. Examine the variable-frequency behavior of the basic circuit elements: R, L, and C, in an AC circuit, as it relates to network functions, the definition of poles and zeros, Bode plots, and to series and parallel resonant circuits and their application as basic low-pass, high-pass, band-pass, and band rejection filters.	Lecture Problem-Solving Assignments Design of Experiments	Section Examination Design of Experiments Review
5. Apply the Laplace transform of signals common to electric circuits, including inverse Laplace transforms using partial fraction expansion, convolution, and the initial-value and final-value theorems to analyze transient circuits.	Lecture Problem-Solving Assignments Design of Experiments	Section Examination Design of Experiments Review

LEARNING OUTCOMES	LEARNING ACTIVITIES	EVALUATION METHODS
6. Construct the s-domain circuit for an electric circuit and solve for voltages and/or currents in the same using the inverse Laplace transform as well as determine the transfer function, response to unit step and impulse functions, and the steady-state response to a sinusoidal source using a transfer function.	Lecture Problem-Solving Assignments Design of Experiments	Section Examination Design of Experiments Review
7. Describe the trigonometric and exponential Fourier series for a periodic signal and the effects of waveform symmetry on the coefficients of a trigonometric Fourier series and calculate the steady-state response of an electric circuit when excited by a periodic voltage or current signal, including the average power in an electric circuit excited by a periodic voltage or current signal.	Lecture Problem-Solving Assignments Design of Experiments	Section Examination Design of Experiments Review

At the conclusion of each semester/session, assessment of the learning outcomes will be completed by course faculty using the listed evaluation method(s). Aggregated results will be submitted to the Associate Vice President of Academic Affairs. The benchmark for each learning outcome is that *70% of students will meet or exceed outcome criteria*.

SEQUENCE OF TOPICS:

1. Steady-State Power Analysis

a. Instantaneous Power
b. Average Power
c. Maximum Average Power Transfer

    d. Effective or Rms Values
    e. The Power Factor
    f. Complex Power
    g. Power Factor Correction
    h. Single-Phase Three-Wire Circuits
    i. Safety Considerations
    j. Application Examples
    k. Design Applications

2. Magnetically Coupled Networks

    a. Mutual Inductance
    b. Energy Analysis
    c. The Ideal Transformer
    d. Safety Considerations
    e. Application Examples
    f. Design Applications

3. Polyphase Circuits

    a. Three-Phase Circuits
    b. Three-Phase Connections
    c. Source/Load Connections
    d. Power Relations
    e. Power Factor Correction
    f. Application Examples
    g. Design Examples

4. Variable Frequency Network Performance

    a. Variable Frequency Response Analysis
    b. Sinusoidal Frequency Analysis
    c. Resonant Circuits
    d. Scaling
    e. Filter Networks
    f. Application Examples
    g. Design Examples

5. The Laplace Transform

    a. Definition
    b. Two Important Singularity Functions
    c. Transform Pairs
    d. Properties of the Transform
    e. Properties of the Inverse Transform
    f. Convolution Integral
    g. Initial Value and Final Value Theorems
    h. Applications Examples

6. Application of The Laplace Transform to Circuit Analysis

    a. Laplace Circuit Solutions
    b. Circuit Element Models
    c. Analysis Techniques
    d. Transfer Functions
    e. Pole-Zero Bode Plot Connection

f. Steady-State Response
g. Application Examples
h. Design Examples

7. Fourier Analysis Techniques

a. Fourier Series
b. Fourier Transforms
c. Application Examples
d. Design Examples

LEARNING MATERIALS:
Present selected text:
Irwin, J.D. and Nelms, R.M. (2011). *Basic Engineering Circuit Analysis* (10th ed.). Wiley.

Simulation software – Multisim

Other learning materials may be required and made available directly to the student and/or via the College's Libraries and/or course management system.

COURSE APPROVAL:

Prepared by:	Dr. David Brookstein, Dean for STEM	Date: 3/9/2013
VPAA/Provost or designee Compliance Verification:		
	Victoria L. Bastecki-Perez, Ed.D.	Date: 4/16/2013
Revised by:	Gayathri Moorthy, Ph.D.	Date: 12/21/2017
VPAA/Provost or designee Compliance Verification:		Date: 1/10/2018

This course is consistent with Montgomery County Community College's mission. It was developed, approved and will be delivered in full compliance with the policies and procedures established by the College.