Montgomery County Community College
EGR 211
Linear Electrical Systems I
4-3-3

COURSE DESCRIPTION:
This course covers the fundamental laws and procedures of electric circuit analysis including Kirchhoff's laws, superposition, and Thévenin's and Norton's theorems. Elementary transients, sinusoidal steady-state analysis, impedance, power transfer, and operational amplifiers are covered. 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 111 Engineering Computations
- MAT 190 Calculus I

Previous or Concurrent Course Requirements
- MAT 201 Calculus II
- PHY 152 Principles of Physics II

LEARNING OUTCOMES Upon successful completion of this course, the student will be able to:	LEARNING ACTIVITIES	EVALUATION METHODS
1. Utilizing the SI system of units and standard prefixes, determine the basic electrical quantities of voltage, current, and power absorbed in a simple series or parallel circuit, using the passive sign convention.	Lecture Problem Solving Assignments Design of Experiments	Section Examination Design of Experiments Review

LEARNING OUTCOMES	LEARNING ACTIVITIES	EVALUATION METHODS
2. Apply Ohm's and Kirchoff's laws to solve for voltage and current in both single-loop and single-node-pair circuits, incorporating both independent and dependent sources and including the application of y-delta transformations in the analysis of the same.	Lecture Problem-Solving Assignments Design of Experiments	Section Examination Design of Experiments Review
3. Employ Kirchhoff's current law (KCL) or Kirchoff's voltage law, whichever is deemed more appropriate, to perform nodal analysis or loop analysis respectively to calculate all currents and voltages in circuits that contain multiple nodes and loops.	Lecture Problem-Solving Assignments Design of Experiments	Section Examination Design of Experiments Review
4. Analyze the behavior of the operational amplifier including a variety of circuits that employ the use of the same and describe the behavior of such devices in practical applications.	Lecture Problem-Solving Assignments Design of Experiments	Section Examination Design of Experiments Review
5. Apply the concepts of linearity and equivalence to analyze electric circuits using the principles of Superposition, and Thévenin and Norton equivalence, including the appropriate use of source transformation and maximum power transfer.	Lecture Problem-Solving Assignments Design of Experiments	Section Examination Design of Experiments Review

LEARNING OUTCOMES	LEARNING ACTIVITIES	EVALUATION METHODS
6. Examine circuit behavior for inductors and capacitors in order to calculate voltage, current, power, and stored energy in and through the same and to determine inductive and capacitive equivalency.	Lecture Problem-Solving Assignments Design of Experiments	Section Examination Design of Experiments Review
7. Calculate initial and time-dependent values for inductor currents and capacitor voltages in both first and second-order transient circuits.	Lecture Problem-Solving Assignments Design of Experiments	Section Examination Design of Experiments Review
8. Perform phasor and inverse-phasor transformations, draw phasor diagrams, and calculate impedance and admittance for the basic circuit elements: R, L, C, including computing and combining impedances and admittances in series and parallel, where necessary, to find current and voltage.	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. Basic Concepts

- a. Systems of Units
- b. Basic Quantities
- c. Circuit Elements

2. Resistive Circuits

- a. Ohm's Laws
- b. Kirchhoff's Laws
- c. Single Loop Circuits

d. Single Node Pair Circuits
e. Series and Parallel Resistor Combinations
f. Circuits with Series-Parallel Combinations
g. Y-Delta Combinations
h. Circuits with Dependent Sources
i. Resistor Technologies for Electronics Manufacturing
j. Application Examples
k. Design Applications

3. Nodal and Loop Analysis Techniques

a. Nodal Analysis
b. Loop Analysis
c. Application Examples
d. Design Examples

4. Operational Amplifiers (Op-Amps)

a. Op-Amp Models
b. Fundamentals of Op-Amp Circuits
c. Comparators
d. Application Examples
e. Design Examples

5. Additional Analysis Techniques

a. Superposition
b. Thévenin's and Norton's Theorems
c. Maximum Power Transfer
d. Application Examples
e. Design Examples

6. Capacitance and Inductance

a. Capacitors
b. Inductors
c. Capacitor-Inductor Combinations
d. RC Operational Amplifier Circuits
e. Application Examples
f. Design Examples

7. First-and Second Order Transient Circuits

a. First-Order Circuits
b. Second-Order Circuits
c. Application Examples
d. Design Examples

8. AC Steady State Analysis

a. Sinusoids
b. Sinusoidal and Complex Forcing Functions
c. Phasors
d. Phasor Relationships for Circuit Elements
e. Impedance and Admittance
f. Phasor Diagrams
g. Basic Analysis Using Kirchhoff's Laws
h. Analysis Techniques

i. Application Examples
j. 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: William Brownlowe Date: 7/26/1998
Revised by: Dr. David Brookstein, Dean for STEM Date: 3/8/2013
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.