EET 131 Circuit Analysis 1

Course Description: A course on DC electric circuits. Topics include: current, voltage, resistance, and power; laws applied to series, parallel, and series-parallel circuits; Thevenin's, Superposition, and Norton's theorems; steady state and transient behavior of capacitive and inductive devices; and magnetic properties.

Prerequisites(s): MAT 121 (minimum grade C) or appropriate placement test score

Corequisite(s): No corequisite

Lecture Hours: 3	Lab Hours: 2	Credit Hours: 4
Lab Fee: 70	Supplemental Fee: 25	Purpose:
☒ Transfer Assurance Guide Course (TAG)	☐ Transfer Module Course (TM)	
Course Format: Lec/Lab	Grading: A/B/C/D/F/I	
Delivery Method: □ Web □ Hybrid x Classroom		
Semesters Offered: x Fall x Spring x Summer		

Course Primary Text:

Title: Principles Of Electric Circuits Conventional Current Flow 9th Ed.	Edition: 9th
Author(s): T. L Floyd	
Publisher: Pearson	

Supplemental Materials:

Experiments in Basic Circuits, David M. Buchla, 9th Ed., Pearson/Prentice Hall
Seven segment display kit

Course Outcomes:

1	Students should demonstrate the understanding of scientific and engineering notation, proper engineering prefixes, and the concept of order of magnitude in technical calculations.
2	Students should be able to explain the fundamental concepts of voltage and current, how these concepts relate to electron flow, and how material properties correlate to electrical resistance.
3	Students should illustrate the proper use of measurement equipment such as power supplies and multimeters and demonstrate the relationship between voltage, current, resistance, and power in the laboratory setting.
4	Students should be able to calculate key parameters, such as resistance, supply power, and total circuit current for series, parallel, and series-parallel circuits.
5	Students should be able to apply key circuit network theorems, such as superposition, Thevenin, and Norton's theorems to fundamental DC circuits.

6	Students should differentiate the critical differences between capacitive and inductive circuits within DC circuits as compared to AC circuits.

Course Topics:

Topic 1	**Introduction, Quantities and Units** 1. Units of Measure. 2. Metric Prefixes. 3. Scientific Notation. 4. Engineering Notation. 5. Conversions within and between systems of units. 6. Electrical quantities and symbols.	**2 Hours**
Topic 2	**Voltage and Current** 1. Atomic Structure. 2. Charge (Coulombs Law). 3. Energy. 4. Mass. 5. Time. 6. Voltage. 7. Current.	**2 Hours**
Topic 3	**Resistance** 1. Resistance of circular wires. 2. Wire tables. 3. Temperature effects. 4. Conductance. 5. Conductive materials. 6. Insulators.	**4 Hours**
Topic 4	**Ohm's Law** 1. Ohm's Law. 2. Relationship of voltage, current and resistance. 3. Calculating voltage, current and resistance. 4. Basic circuit structures.	**2 Hours**
Topic 5	**Energy and Power** 1. Time rate of doing work (J/s, units of measure). 2. Energy conversions (heat, light, mechanical). 3. Power in electric circuits (E x I). 4. Power equations derived using Ohm's Law (I^2R, E^2/R). 5. Design safety factor. 6. Basic motor circuits (horsepower conversion). 7. Efficiency (P_{out}/P_{in}). 8. Residential, commercial and industrial energy consumption (KWH).	**4 Hours**
Topic 6	**Series Circuits** 1. Circuit structure. 2. Current in a series circuit. 3. Total resistance. 4. Total equivalent circuit. 5. Voltage distribution across series elements. 6. Application of Ohm's Law. 7. Kirchhoff's Voltage Law. 8. Series aiding and series opposing voltage sources. 9. Voltage Divider Rule. 10. Concept of ground. 11. Single and double subscript notation.	**4 Hours**

		12. Power in series circuits. 13. Effects of open and short circuits. 14. Practical applications of series circuits.
Topic 7	**Parallel Circuits**	**3Hours** 1. Circuit structure. 2. Current in a parallel circuit. 3. Voltage distribution across parallel elements. 4. Methods of calculating total resistance. a. Conductance Method. b. Product/Sum Method. c. Method of Like Resistance. 5. Total equivalent circuit. 6. Application of Ohm's Law. 7. Kirchhoff's Current Law. 8. Current Divider Rule. 9. Voltage sources in parallel. 10. Current sources in parallel. 11. Power in parallel circuits. 12. Effects of open and short circuits. 13. Practical applications of parallel circuits.
Topic 8	**Series-Parallel Circuits**	**6 Hours** 1. Identifying series-parallel relationships. 2. Circuit reduction to total equivalency. 3. Analysis of current, voltage and power distribution. 4. Unloaded and Loaded Voltage Divider networks (analysis and design). 5. Ladder Networks analysis and design (R/2R). 6. Wheatstone Bridge network analysis and design (balanced and unbalanced).
Topic 9	**Network Theorems/Methods of Analysis**	**8 Hours** 1. Ideal and non-ideal voltage sources. 2. Ideal and non-ideal current sources. 3. Source conversions. 4. Superposition Theorem. a. Analysis with multiple voltage sources. b. Analysis with multiple current sources. c. Analysis with multiple mixed sources. 5. Thevenin's Theorem. a. Determining Thevenin's equivalent resistance (R_{TH}). b. Determining Thevenin's equivalent voltage (V_{TH}). c. Thevenin's equivalent circuit. d. Analysis of single source networks. e. Analysis of multi-source networks. 6. Norton's Theorem. a. Determining Norton's equivalent resistance (R_N). b. Determining Norton's equivalent current (I_N). c. Norton's equivalent circuit. d. Analysis of single source networks. e. Analysis of multi-source networks. 7. Maximum Power Transfer Theorem. a. Application of theorem. b. Calculation of load values for Max. Power. 8. Delta to Wye and Wye to Delta Conversions for resistive networks. 9. Methods of Analysis a. Branch Method. b. Mesh Method. c. Nodal Method.

Topic 10	**D. C. Capacitive Networks** 1. Capacitor construction. 2. Charge storage. 3. Calculating capacitance (electrical). a. C = Q/V. 4. Energy storage. a. $W = (V^2C)/2$. 5. Calculating capacitance (physical). a. Plate area. b. Dielectric thickness. c. Permittivity of air (εo). d. Relative Permittivity of dielectric material (εr). e. Dielectric strength. 6. Capacitors in series. a. Determining total capacitance. b. Calculating charge. c. Determining voltage distribution. 7. Capacitors in parallel. a. Determining total capacitance. b. Calculating charge. c. Determining voltage distribution. 8. Steady state conditions for the Resistive/Capacitive Network. a. Analysis of R-C circuits at steady state. 9. Analysis of Transient Resistive/Capacitive Networks. a. The Time Constant (τ = R x C). b. Universal time constant chart. c. Introduction to logarithms. d. Analysis of charging R-C networks. i. $v_C = Es (1-\varepsilon^{-t/\tau})$. ii. $v_R = Es (\varepsilon^{-t/\tau})$. iii. $i_C = Es/R_T (\varepsilon^{-t/\tau})$. iv. Solving for time (t). v. Response to D.C. pulse. e. Analysis of discharging R-C networks. i. $v_C = V_F (\varepsilon^{-t/\tau})$. ii. $v_R = V_F (\varepsilon^{-t/\tau})$. iii. $i_C = V_F/R_T (\varepsilon^{-t/\tau})$. iv. Solving for time (t). f. Transient Analysis using Superposition and Thevenin's Theorems. g. Determining instantaneous capacitor current. a. i = C (dv/dt). h. Practical applications of capacitive networks.	**6 Hours**
Topic 11	**Magnetism and Electromagnetism** 1. The magnetic field. 2. Magnetic flux (ϕ). 3. Flux density (B). 4. Hysteresis (H). 5. Magnetic materials. 6. Electromagnetism. a. Right Hand Rule. b. Permeability. c. Reluctance. d. Magneto motive Force. e. The electromagnetic. 7. Electromagnetic devices.	**2 Hours**

	a. Solenoids. b. Relays. c. Reed switches. 8. Electromagnetic induction. a. Faraday's Law. b. Lenz's Law.
Topic 12	**D.C. Inductive Networks** **4 Hours** 1. The basic inductor. 2. Unit of measure. 3. Calculating self induced voltage (electrical/magnetic). a. Lenz's Law $v_{ind} = L\ (di/dt)$. b. Faraday's Law $v_{ind} = N\ (d\phi/dt)$. 4. Energy storage. a. $W = I^2L/2$. 5. Calculating inductance (physical). a. Number of turns. b. Core area. c. Permeability of air (μo). d. Relative Permeability of core material (μr). e. Core length. f. Winding resistance. g. Winding capacitance. 6. Inductor types. a. Air core. b. Iron core. c. Ferrite core. d. Symbols. 7. Inductors in series. a. Determining total Inductance. b. Calculating current. c. Determining voltage distribution. 8. Inductors in parallel. a. Determining total inductance. b. Calculating current. c. Determining voltage distribution. 9. Steady state conditions for the Resistive/Inductive Network. a. Analysis of R-L circuits at steady state. 10. Analysis of Transient Resistive/Inductive Networks. a. The Time Constant ($\tau = L/R$). b. Universal time constant chart. c. Analysis of charging R-L networks. i. $v_L = Es\ (\varepsilon^{-t/\tau})$ ii. $v_R = Es\ (1-\varepsilon^{-t/\tau})$ iii. $i_L = Es/R_T\ (1-\varepsilon^{-t/\tau})$ iv. Solving for time (t) v. Response to D.C. pulse f. Transient Analysis using Superposition and Thevenin's Theorems. g. Effect of rapid decay of inductive current. a. Inductive kick voltage b. . Lenz's Law $v_{ind} = L\ (di/dt)$ h. Practical applications of inductive networks.

Methods of Evaluation/Assessment

Test 1	15% Total Semester Grade
Test 2	15% Total Semester Grade
Final Exam (Lecture)	20% Total Semester Grade
Quizzes	15% Total Semester Grade
Homework	5% Total Semester Grade
Laboratory	15% Total Semester Grade
Final Exam (Laboratory)	15% Total Semester Grade

Quizzes: Quiz every Friday 15 – 20 min. in length.

Test 1: Week of _____________. Will notify of exact day one week in advance. Exam will cover first (5) weeks of course material. Test will be 2 hours in length. Closed book.

Test 2: Week of _____________. Will notify of exact day one week in advance. Exam will cover second (5) weeks of course material. Test will be 2 hours in length. Closed book.

Final Exam: Week of _____________. Will notify of exact day one week in advance. Exam will be comprehensive. Test will be 2 hours in length. Closed book.

Course Keeper: Ron Singleton

Date Completed: April 16, 2019