ESYST 102 - Circuit Analysis

Approval Date:  Effective Term:

Department: ELECTRONIC SYSTEMS TECHNOLOGY
Division: Career Technical Education
Units: 4.00
Grading Option: Letter Grade
Transferability: CSU Transferable
Course is: AA/AS Degree
Repeatability:
Contact Hours per Term:
   Lecture/Discussion: 3.00
   Lab: 3.00
Associate Degree GE Applicability: No
Recommended Class Size: 35

Discipline/Minimum Qualifications:

Catalog Description:
Explores the functionality of basic electronic components as used in various types of circuits.

Schedule Description:
Explores the functionality of basic electronic components as used in various types of circuits.

Student Learning Outcome:
Lecture:
   1. Analyze electronic circuits including instrumentation for measuring voltage, current, resistance, impedance, and capacitance in various types of circuits.

Lab:
   1. Measure electrical outputs for various types of circuits, diagnose problems, and correct as necessary to achieve projected outputs.

Course Objectives:
Lecture:
   1. Compare and contrast the effects of capacitance and inductance in circuits.
2. Describe the properties of magnetic fields and materials.
3. Explain electromagnetism, electromagnetic induction, and relate to the operation of common magnetic devices.
4. Apply Ohm’s and Kirchhoff’s laws to solve series, parallel, and series-parallel circuit problems.
5. Explain the construction and operation of a transformer and make transformer calculations of voltage step-up/down and impedance.
7. Define and identify a sine wave and determine frequency, period, peak, peak-to-peak (pp) and root mean square (rms) values.
8. Calculate projected electrical signal outputs for given DC series-parallel resistive circuits.
9. Calculate projected electrical signal outputs for a given RC circuit.
10. Calculate projected electrical signal outputs for a given RL circuit.
11. Calculate projected electrical signal outputs for a given RLC circuit.

Lab:

1. Demonstrate the use of various electronic measuring instruments.
2. Measure electrical signal outputs for given DC series-parallel resistive circuits.
3. Measure electrical signal outputs for a given RC circuit.
4. Measure electrical signal outputs for a given RL circuit.
5. Measure electrical signal outputs for a given RLC circuit.

Course Content Outline:
Lecture:

1. Survey of common test instruments, specifications, applications, measurement examples
   1. Spectrum analyzers
   2. LCR meters
   3. RF test equipment (frequency counters, field strength, SWR, power, EMI)
   4. Digital signal analyzers
   5. Virtual instruments
   6. Synthetic instruments
   7. Automatic test instrument systems
   8. GPIB, PXI and LXI instruments
   9. Boundary scan and JTAG
2. Data Acquisition Fundamentals
   1. Data acquisition defined
   2. Block diagram analysis of a data acquisition system
   3. Sensors overview
   4. Signal Conditioning
   5. Multiplexing
   6. AD/DA principles review
   7. Data capture and storage
   8. Data acquisition software and processing
3. DC Series Resistive Circuits
1. Resistors in Series
2. Rules and Laws for Series Circuits
3. Voltage Dividers
4. Ground
5. Troubleshooting Series Circuits

4. DC Parallel Resistive Circuits
   1. Resistors in Parallel
   2. Rules and Laws for Parallel Circuits
   3. Current Sources
   4. Current Dividers and Applications
   5. Troubleshooting Parallel Circuits

5. DC Series Parallel Circuits
   1. Series-Parallel Relationships
   2. Analysis of Series-Parallel Circuits
   3. Loaded Voltage Dividers
   4. Ladder Networks and the Wheatstone Bridge
   5. Troubleshooting

6. Introduction to Alternating Current and Voltage
   1. Sine Waves
   2. Non-sinusoidal Waveforms
   3. Voltage Measures, Frequency, and Period

7. Capacitance and Inductance
   1. Definition, Units of Measure, and Physical Properties
   2. Circuit Configurations, Total Capacitance, and Inductance
   3. DC and Transient Analysis of RC and RL Circuits
   4. Capacitance and Inductance in AC Circuits

8. Magnetism and Electromagnetism
   1. Magnetic Fields
   2. Electromagnetism
   3. Hysteresis
   4. Induction
   5. Applications of Electromagnetism and Induction

9. Transformers
   1. Step Up/Step Down
   2. Loading and Reflected Load
   3. Impedance Matching

10. RC Circuits
    1. Typical Circuit Configurations and Total Impedance
    2. Power in RC Circuits

11. RL Circuits
    1. Circuit Configurations and Total Impedance
    2. Power in RL Circuits

12. RLC Circuits
    1. Circuit Configurations and Total Impedance
    2. Power in RLC Circuits
    3. Resonance
4. Filters

Lab:

1. Instruments and techniques for measuring and troubleshooting electrical signal outputs for DC series-parallel resistive circuits.
   Instruments and techniques for measuring and troubleshooting electrical signal outputs for RC circuits.
2. Instruments and techniques for measuring and troubleshooting electrical signal outputs for RL circuits.
3. Instruments and techniques for measuring and troubleshooting electrical signal outputs for RLC circuits.

Methods of Instruction:
Lab, Lecture:

Methods of Evaluation:
Exams/Tests/Quizzes
Problem Solving
Skill Demonstrations

Exams

Typical Assignments:

**Reading:**
Text Schematics

**Writing, Problem Solving or Performance:**
Design a circuit to achieve a defined objective. Troubleshoot and repair an inoperative circuit.

**Other:**

Required Materials Examples:
Book 1

**Author:** Robert L. Boylestad  
**Title:** Introductory Circuit Analysis  
**Publication Date:** 2010  
**Publisher:** Prentice Hall

Book 2

**Author:** Thomas L. Floyd  
**Title:** Principles of Electric Circuits: Conventional Current Version  
**Publication Date:** 2009  
**Publisher:** Prentice Hall
Course Preparation:

Prerequisite(s): CMPELC 130, ESYST 101

Co-Requisite(s):

Recommended:

None

None

Document Content Review

Target Course Skills

Condition on Enrollment

Established

Faculty

Samuel Bolanos Lee Hilliard

Basic Content Review

1. Apply Ohms Law, power equations, Kirchoff's voltage Law, and knowledge of logical operators to solve various electronic calculations. 2. Predict the behavior and operation of electronic circuits that have resistors, capacitors, and inductors as circuit elements. 3. Test and troubleshoot AC, DC and digital circuits using electrical monitoring equipment.

Condition on Enrollment

Established

Faculty

Lee Hilliard Samuel Bolanos

Basic Content Review

Differentiate conductor, insulator and semiconductor materials. Compare and contrast the most common types of wire and cable, state where each is used, and make basic wire/cable tests and measurements. Interpret Kirchoff's Laws as they apply to electronic systems. Calculate the resistance in a basic DC circuit given voltage and amperage using Ohm's law. Explain the basic use of multimeters, power supplies, function generators, and oscilloscopes. Assess basic methods and procedures for troubleshooting. Lab: Construct a simple DC circuit on a breadboard. Measure resistance, current, and voltage on basic DC and AC circuits. Perform troubleshooting on basic DC and AC circuits.