ELEC A111: D.C. CIRCUITS

Item	Value
Curriculum Committee Approval Date	10/30/2024
Top Code	093400 - Electronics and Electric Technology
Units	3 Total Units
Hours	90 Total Hours (Lecture Hours 36; Lab Hours 54)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Open Entry/Open Exit	No
Grading Policy	Standard Letter (S)

Course Description

D.C. Circuits is an in-depth study of Direct Current (DC) electronic circuits. Students will learn how to interpret and create electrical schematics. Topics of study include Ohm's Law, Kirchhoff's Laws, resistance, capacitance, and inductance. Students will gain hands-on experience with wiring to include soldering, crimping, and heat shrinking. In the lab, students will learn how to use multimeters, power supplies, and oscilloscopes to build and analyze common DC Circuits. The lab work will focus on validating theoretical calculations by building circuits and testing them for expected performance. Transfer Credit: CSU.

Course Level Student Learning Outcome(s)

1. Students will be proficient at using electronic test equipment to measure and analyze the performance of DC circuits.
2. Students will be able to communicate the results of their analysis in a professional manner using industry standard schematics and report formats.
3. Students will be able to employ mathematical tools and fundamental laws to conduct analysis of complex DC circuits.

Course Objectives

- 1. Use scientific terms to explain in theoretical terms how atomic particles produce electricity, define the forces of electricity, and explain the relationship between magnetism and electricity.
- 2. Identify passive components and describe their function in the electric circuit and their specifications, accurately express values in both scientific and engineering notation.
- 3. Create all technical drawings and documents per industry standards.
- 4. Calculate all circuit values (power, voltage, current, and resistance) for all connection types: simple, series, parallel, and combinations thereof.
- 5. Analyze complex DC circuits including voltage dividers, current dividers, Thevenin's theorem, superposition, and other circuit analysis methods.
- 6. Design, build, measure, analyze, and evaluate complex DC circuits.

Lecture Content

Introduction to Electric Charge and Electricity Atomic theory Magnetism Electro-Magnetism Properties of Magnets Units of measure Magnetic Circuits Ohm's Law for magnetic circuits Thermodynamics Electro-Magnets Lenz s Law Hysteresis Applications- Solenoids and Relays Chemistry Batteries Voltage cells, series and parallel Insulators Definition Breakdown Properties Conductors Definition Materials and current capacity Capacitors Electro-Static Charge Construction- Plates and Dielectrics Types DC characteristics Units- Farads Working Voltage Polarity Parallel and Series Capacitors Engineering Math Methods Metric prefixes Engineering notation Scientific notation Ohm s Law and Watt s Law Ohm s Law- Voltage, Current, and Resistance Watt s Law- Power, Voltage and Current Multimeters and Measurement Techniques Measurement of current voltage and resistance Multimeters- analog and digital Oscilloscope DC measurement Data Analysis Calculated vs. Measured values Significant figures Empirical data Tables and spreadsheets Analyzing results Resistance Definition and Properties Insulators Conductors Resistance formula coefficients Rho Length Temperature Luminosity Cross sectional area DC Series and Parallel Circuits Kirchhoff s Laws Series Circuit Analysis Series Circuit Applications voltage divider potentiometer Capacitors LED Parallel Circuit Analysis Parallel Circuit Application Current Divider Capacitor Series and Parallel Circuit Analysis 3 device Complex Circuits Advanced Applications R2R Ladder Wheatstone Bridge Network Theorems Voltage sources and current sources Thevenin's Theorem Maximum Power Transfer Theorem Superposition Theorem Norton's Theorem DC Switching Circuits Transistor Relay Capacitor RC Time constant Integrated Circuits- 555 Timer

Lab Content

Fundamental Circuits Simple lamp circuit Lamp switch Solenoid Relay Motor Resistors and Measurement Test leads and wire gage Sensors Test instruments Resistor Color Code Series DC Circuits Batteries Electro-Magnets LED Voltage Divider Potentiometer Parallel DC Circuits Batteries, Speakers, Capacitors Electro-Magnets Resistor Circuits Load Bank Series and Parallel Matrices Series-Parallel Parallel-Series Practice Circuits R2R Ladder Wheatstone Bridge Advanced Circuit Analysis Thevenin Circuit Analysis Maximum Power Transfer Industry Standard Documentation Symbols System Diagrams Schematic Diagrams Wiring Diagrams Data Tables and Spreadsheets Lab Technical Report Final Project Transistor Circuit Relay Circuit Measurement of Capacitor RC Time Constant

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- DE Online Lecture (02X)
- Lab (04)
- DE Live Online Lab (04S)
- DE Online Lab (04X)

Instructional Techniques

Lecture Detailed whiteboard lectures with opportunity for student engagement. Independent in-class problem solving assignments with immediate review. Group based in-class problem solving assignments with immediate review. In-class review of previously assigned homework. Discussion of media provided and assigned via Canvas. Review of material prior to exams. Lab Students build and test electronic circuits individually and as groups. Lab projects reinforce lecture topics and are paced to coincide or lag the lecture content. Lab projects generate

content that students use to generate reports and documentation, enhancing writing and critical thinking skills.

Reading Assignments

Students will spend 2-3 hours per week on assigned readings from text, canvas, and handouts.

Writing Assignments

Students will spend approximately 3-5 hours per week on writing assignments, including: Keep a journal of chronological notes taken during research, lecture, and laboratory experience. Author a technical report for each project written to industry standards for technical reports.

Out-of-class Assignments

Students will spend approximately 5 hours per week on out-of-class assignments, including: Researching topics as assigned Preparing technical documents prior to laboratory projects Completing of technical reports after each project Maintaining a portfolio of projects throughout the semester.

Demonstration of Critical Thinking

Electrical circuit analysis and problem solving assignments. Group problem solving projects. Quizzes administered at the end of each topic to demonstrate mastery of the specific objective. Midterm and final exam administered to test ability to retain problem solving skills. Perform diagnostics procedures to evaluate circuit performance.

Required Writing, Problem Solving, Skills Demonstration

Keep a journal of chronological notes taken during lecutre, research, and lab time. Maintain a portfolio of technical reports, research and class notes. Submit technical reports for lab projects containing results and analysis.

Eligible Disciplines

Electricity (electrical power distribution): Any bachelor's degree and two years of professional experience, or any associate degree and six years of professional experience. Electromechanical technology (industrial mechanical technology): Any bachelor's degree and two years of professional experience, or any associate degree and six years of professional experience. Electronic technology (radio, television, computer repair, avionics): Any bachelor's degree and two years of professional experience, or any associate degree and six years of professional experience. Electronics: Any bachelor's degree and two years of professional experience, or any associate degree and six years of professional experience. Engineering technology: Master's degree in any field of engineering technology or engineering OR bachelor's degree in either of the above AND master's degree in physics, mathematics, computer science, biological science, or chemistry, OR bachelor's degree in industrial technology, engineering technology or engineering AND a professional engineer's license OR the equivalent. Master's degree required.

Textbooks Resources

1. Required Schulz, M.. Grob's Basic Electronics, 12 ed. New York, NY: Glencoe McGraw-Hill, 2015 Rationale: -15th edition ISBN:125922953X / 9781259229534 2. Required Boylestad, Robert L. . Introductory Circuit Analysis, 13 ed. Upper Saddle River, NJ: Prentice Hall, 2015

Other Resources

1. Canvas Course