CareerClusters™ PATHWAYS TO COLLEGE & CAREER READINESS
Manufacturing

Learning that works for Colorado CTE®

Colorado CTE Course – Scope and Sequence

Course Name	Electronics- Analog/Robotics	Course Details	Credit= 0.5
		Course = 0.50 Carnegie Unit Credit	**Prerequisite: Robotics and Automated Systems** **CTE Credential: CTE Manufacturing; CTE STEM**
Course Description	An in-depth study of series-parallel circuits, inductive and capacitive reactance, rectification, amplification, voltage regulation, semi-conductors, and robotics will be conducted. Electronic theory is reinforced through breadboarding circuits in the lab. Students will program robots to perform a specific task.		
Note:	This is a suggested scope and sequence for the course content. The content will work with any textbook or instructional resource. If locally adapted, make sure all essential knowledge and skills are covered.		
SCED Identification #	17111	Schedule calculation based on 60 calendar days of a 90-day semester. Scope and sequence allows for additional time for guest speakers, student presentations, field trips, remediation, or other content topics.	

All courses taught in an approved CTE program must include Essential Skills embedded into the course content. The Essential Skills Framework for this course can be found at **https://www.cde.state.co.us/standardsandinstruction/essentialskills**

Instructional Unit Topic	Suggested Length of Instruction	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration
Safety		Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the manufacturing sector workplace environment.	The student practices safe and proper work habits. The student is expected to: (A) master relevant safety tests; (B) comply with safety guidelines as described in various manuals, instructions, and regulations; (C) identify governmental and organizational regulations for health and safety in the	Accurately read and interpret safety rules, including but not limited to rules published by the National Science Teachers Association (NSTA), rules pertaining to electrical safety, Occupational Safety and Health Administration (OSHA) guidelines, and state and national code requirements. Be able to distinguish between the rules and explain why certain rules apply.	

			workplace related to electronics; (D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations; (E) dispose of hazardous materials and wastes appropriately; (F) perform maintenance on selected tools, equipment, and machines; (G) handle and store tools and materials correctly; and (H) describe the results of improper maintenance of material, tools, and equipment.	Identify and explain the intended use of safety equipment available in the classroom. For example, demonstrate how to properly inspect, use, and maintain safe operating procedures with tools and equipment.	
Career Development		Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.	The student demonstrates the skills necessary for success in a technical career. The student is expected to: (A) distinguish the differences between an engineering technician, engineering technologist, and engineer;	In teams, develop a persuasive paper or presentation arguing for the importance of electrical and/or computer engineers' contributions to society. Select several such contributions as justification, and provide compelling evidence for how	

		Identify career paths available in manufacturing and electronics.	(B) identify employment and career opportunities; (C) identify industry certifications; (D) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects; (E) identify and demonstrate respect for diversity in the workplace; (F) identify and demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality; (G) explore electronics engineering careers and preparation programs; (H) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	electrical/computer engineers' designs are used in everyday applications. Incorporate a variety of sources to gather data, including print and electronic; cite each source, and briefly describe why the particular source is reliable. Research the postsecondary institutions in Colorado that offer electrical engineering or electrical and/or computer engineering technology. Individually or in teams, develop and publish information that identifies admissions criteria, the postsecondary programs of study, and the secondary courses that will prepare students for success after high school in electrical or computer engineering fields. Cite each source adhering to standard citation conventions used in engineering disciplines. Investigate local employment opportunities requiring skills in robotics. Identify preferred requirements and certifications. Analyze the student ICAP for gaps in developing preferred	

				experience or requirements and identify ways to fulfill these requirements.	
Circuits, Sources, and Loads		Understand and apply electrical scientific concepts to electronic operations and component functions.	Student understands and apply electrical concepts. Student is expected to: (A) define charge, current, voltage (B) understand concepts related to sources and Loads: power, resistors, sources (C) understand how scientific laws and principles are used in DC circuit analysis: Kirchhoff's laws, series and parallel resistors, voltage divider, current divider, Thevenin's theorem, analysis strategies; (D) understand Energy and power sources: batteries, efficiency, maximum power transfer; and (E) apply AC concepts: DC and AC, sinusoidal functions, AC voltage and current, RMS		
Power Supplies		Understand how power supplies are used in analog electronic components and systems.	Apply understanding of power supplies ad diodes to analog electronic components and systems. Student is expected to:		

			(A) explain Diode characteristics, construction and operation; (B) identify diode order models; (C) understand half wave rectifiers and how to calculate peak output voltage; (D) explain how capacitors function; (E) understand voltage ripple; (F) understand concepts related to full wave rectifiers: voltage ripple, transformers (G) identify Voltage regulators doublers, and inductors; (H) understand how DC-DC converters function and identify transistors as switches, RL circuits, and switched regulators.		
Machines and Power Electronics		Understand and apply knowledge of DC motors to analog electronics and simple machines.	Understand how DC motors function in analog electronic applications. Student is expected to : (A) Apply concepts of the work done by simple machines: force on a conductor, motor and		

			generator action, commutation, DC motors; (B) apply Faraday's law, to DC generators, and AC motors; (C) understand how DC machines operate; (D) define terminology related to DC machines: equivalent circuit model, torque/current and voltage/speed relationships, performance parameters, efficiency; (E) define terminology related to AC machines: rotating magnetic fields, synchronous machines, inductor motors, comparison of electric machines; (F) understand concepts related to Power electronics: speed control of DC motors, pulse width modulation, H bridges, and H-bridge drive of DC motors.		
Linear Amplifiers		Understand the concept of amplification in analog electronics.	Amplifier concepts: input resistance and output resistance, gain, offset,		

		Explain the operation of circuits using transistors in switching mode to achieve a variable DC output.	maximum output voltage and current, differential amplifiers Op-amps: concept, equivalent circuit model, inverting, non-inverting and summing amplifiers, power op-amps Transistors: principles of BJTs and MOSFETs, simple models, linear amplifier configurations Frequency dependent gain: frequency response, RC transfer function, cross-over frequency, low pass and high pass filters		
RLC Circuits		Explain the transient behavior of RLC circuits.	Superposition Norton's Theorem Mesh analysis Nodal analysis Time domain response: RC, RL and RLC networks, transient response, steady state DC response, step response, periodic response		
Steady State Sinusoidal Analysis		Use piecewise linear models to predict the steady state behavior of simple diode and transistor circuits, AC and DC motors.	Complex signals and impedance: complex exponentials, complex arithmetic in Cartesian and polar form, complex impedance Phasors Filters: RC filters, buffered and unbuffered bandpass filters, RL filters, active filters Resonant Circuits: series and parallel resonant		

			circuits, resonant frequency, bandwidth, quality factor		