

Colorado AFNR Course Scope and Sequence

Course Name	Plumbing & Electrical Installation		Course Details	Level 4 course in the Power, Structure, & Technology pathway. This course aligns with the construction strand.		
			Course = 0.50 Carnegie Unit Credit			
Course Description	Students will acquire knowledge and basic skills in electrical and plumbing technologies including how to identify and use power and hand tools; how to be safe on the jobsite and when using hand and power tools. Plumbing skills will include how to identify, fit, and use industry relevant plumbing pipe materials such as copper, PVC, poly, etc. Plumbing system design and troubleshooting will also be addressed. In addition, students will be introduced to gas, drainage, and water supply systems and continue their knowledge of workplace basics and green technologies. Skills in the electrical area include electrical theory, tool identification and use, electrical codes, installation of electrical equipment, and the reading of electrical drawings, schematics, and specifications.					
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 #	18401	Schedule calculation based on 60% of a semester instructional time. 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						
Unit Number, Title and Brief Description	Suggested % of Instructional Time	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration	
Unit 1: Lab & workplace safety Review of lab safety & expansion of workplace safety expectations	2%	PST.02. Operate and maintain AFNR mechanical equipment and power systems.	PST.02.02. Operate machinery and equipment while observing all safety precautions in AFNR settings.	PST.02.02.02.b. Apply safety principles and applicable regulations to operate equipment, machinery and power units used in AFNR power, structural and technical systems.		
Unit 2: Electrical & Plumbing Careers Understanding certification, entry level training necessary, post-secondary	3%	CRP.10. Plan education and career path aligned to personal goals.	CRP.10.02. Examine career advancement requirements (e.g., education, certification, training, etc.) and create goals for continuous growth in a chosen career.	CRP.10.02.01.b. Analyze the steps to meet career advancement requirements for potential careers		

opportunities and job opportunities					
Unit 3: Review of electrical theory & application - Theory & Application - Amps - Ohms - Volts - Watts - Ohm's law - Conductors & Insulators	2%	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.02. Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.	PST.03.02.01.a. Compare and contrast basic units of electricity (e.g., volts, amps, watts, and ohms) and the principles that describe their relationship (e.g., Ohm's Law, Power Law, etc.).	
Unit 4: Electrical Blueprints	3%	PST.03. Service and repair AFNR mechanical equipment and power systems	PST.03.02. Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.	PST.03.02.02.b. Analyze and interpret electrical system symbols and diagrams.	
Unit 5: Electrical Fixtures & Materials Identification & Applications	3%	PST.04. Plan, build and maintain AFNR structures.	PST.04.04. Apply electrical wiring principles in AFNR structures. <u>SCIENCE: SC.HS.1.8</u>	PST.04.04.02.a. Distinguish electrical circuits and the components of each	
Unit 6: NEC - Purpose - Application - How to read - Other reference materials and guides	2%	PST.04. Plan, build and maintain AFNR structures.	PST.04.04. Apply electrical wiring principles in AFNR structures. <u>SCIENCE: SC.HS.1.8</u>	PST.04.04.01.b. Assess and analyze the electrical requirements of an AFNR structure.	

Unit 7: Using the NEC application for... • Selection of conductors • Ampacity • Length of runs • Voltage drop • Ampacity Charts • Understanding conductor designation	7%	PST.04. Plan, build and maintain AFNR structures.	PST.04.04. Apply electrical wiring principles in AFNR structures. <u>SCIENCE: SC.HS.1.8</u>	PST.04.04.01.c. Install and/or repair fixtures following appropriate codes and standards.	
Unit 8: Service Entrance & Distribution Panels, Circuit Protection	6%	PST.04. Plan, build and maintain AFNR structures.	PST.04.04. Apply electrical wiring principles in AFNR structures. <u>SCIENCE: SC.HS.1.8</u>	PST.04.04.02.c. Plan and wire electrical circuits (i.e., single pole switch, three-way switch, duplex outlet, etc.).	
Unit 9: GFCI & AFCI	2%	PST.04. Plan, build and maintain AFNR structures.	PST.04.04. Apply electrical wiring principles in AFNR structures. <u>SCIENCE: SC.HS.1.8</u>	PST.04.04.02.a. Distinguish electrical circuits and the components of each.	
Unit 10: Wiring Branch Circuits • Pulling Wire • Setting boxes • Connecting fixtures	12%	PST.04. Plan, build and maintain AFNR structures.	PST.04.04. Apply electrical wiring principles in AFNR structures. <u>SCIENCE: SC.HS.1.8</u>	PST.04.04.02.c. Plan and wire electrical circuits (i.e., single pole switch, three-way switch, duplex outlet, etc.).	
Unit 11: Low Voltage Control Systems • Thermostats, relays, transformers	5%	PST.03 Service and repair AFNR mechanical equipment and power systems.	PST.03.02. Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.	PST.03.02.02.a. Compare and contrast the characteristics of electronic components used in AFNR power, structural and technical systems (e.g., battery, resistor, diode, transistor, capacitor, etc.).	
Unit 12: High Voltage Circuits • 220 single phase	3%	PST.04. Plan, build and maintain AFNR structures.	PST.04.04. Apply electrical wiring principles in AFNR structures.	PST.04.04.02.a. Distinguish electrical	

3 phase circuits			<u>SCIENCE: SC.HS.1.8</u>	circuits and the components of each.	
Plumbing					
Unit 13: Blueprints	3%	PST.04. Plan, build and maintain AFNR structures.	PST.04.01. Create sketches and plans for AFNR structures.	PST.04.01.01.a. Interpret and explain the meaning of symbols used in sketches of agricultural structures.	
Unit 14: Plumbing Math - Pressures - Flow Rate - Pipe size - Static and Dynamic Pressure - Friction Loss - Velocity loss (Rain bird irrigation Manuel)	7%	PST.04 Plan, build, and maintain AFNR structures.	PST.04.02 Determine structural requirements, specifications, and estimate costs of AFNR structure.	PST.04.02.01.a Summarize and categorize the information needed to complete a bill of materials and cost estimate for an AFNR structure.	
Unit 15: Plumbing code & regulations	2%	PST.04 Plan, build, and maintain AFNR structures.	PST.04.02 Determine structural requirements, specifications, and estimate costs of AFNR structure.	PST.04.02.02.b Assess and analyze local building code requirements for agriculture structures.	
Unit 16: Plumbing materials and components Types, identification, and application, proper materials for specific applications	3%	PST.04 Plan, build, and maintain AFNR structures.	PST.04.03 Follow architectural and mechanical plans to construct, maintain and/or repair AFNR structures (e.g. material selection, site preparation and/or layout plumbing, concrete/masonry.etc)	PST.04.03.04.a Compare and contrast the characteristics of materials used in plumbing and water systems (e.g. copper, PVC, PEX, etc)	
Unit 17: Building plumbing systems - Supply vs. Waste - Pressure vs. Non Pressure	4%	PST.04 Plan, build, and maintain AFNR Structures	PST.04.02 Determine structural requirements, specifications, and estimate costs of AFNR structure.	PST.04.02.02.a Research and summarize sources of industry construction and materials standard and their importance (e.g. American National Standards Institute, ANSI	

				Underwriters' Laboratories, UL, etc)	
Unit 18: Joining/Testing plumbing materials, PVC, PE, PEX, copper, steel, ABS, similar and non-similar	18%	PST.04 Plan, build, and maintain AFNR Structures	PST.04.03 Follow architectural and mechanical plans to construct, maintain and/or repair AFNR structures (e.g. material selection, site preparation and/or layout plumbing, concrete/masonry.etc)	PST.04.03.04.a Compare and contrast the characteristics of materials used in plumbing and water systems (e.g. copper, PVC, PEX, etc)	
Unit 19: Plumbing system layout & design Installing basic plumbing fixtures	10%	PST.04. Plan, build and maintain AFNR structures.	PST.04.03. Follow architectural and mechanical plans to construct, maintain and/or repair AFNR structures (e.g., material selection, site preparation and/or layout, plumbing, concrete/ masonry, etc.).	PST.04.03.04.c. Install and/or repair pipes and plumbing equipment and fixtures in AFNR structures.	
Unit 20: Rural Waste systems Design operation, and impact of soil characteristics	2%	PST.04. Plan, build and maintain AFNR structures.	PST.04.03. Follow architectural and mechanical plans to construct, maintain and/or repair AFNR structures (e.g., material selection, site preparation and/or layout, plumbing, concrete/ masonry, etc.).	PST.04.03.04.a. Compare and contrast the characteristics of materials used in plumbing and water systems (e.g., copper, PVC, PEX, etc.).	

Academic Standards Alignment

Colorado CTE courses are required to integrate academic and essential skills into course content. The following academic standards have been identified as aligned to this course and should be integrated throughout instruction.

[CO CTE Academic Standards Resources](#) (Rubrics, integration strategies, etc)

[CDE Colorado Academic Standards Online](#) (Online standards lookup tool)

Standard 1: Oral Expression and Listening

Prepared Graduate 1: Collaborate effectively as group members or leaders who listen actively and respectfully; pose thoughtful questions, acknowledge the ideas of others; and contribute ideas to further the group's attainment of an objective.

Students collaborate to interpret construction plans, install plumbing and electrical systems, troubleshoot installation challenges, and safely complete projects while following industry standards and communicating effectively with team members.

Prepared Graduate 2: Deliver effective oral presentations for varied audiences and varied purposes.

Students communicate installation procedures, code requirements, troubleshooting strategies, and project progress through demonstrations, technical discussions, and project presentations using appropriate construction and trade terminology.

Standard 2: Reading for All Purposes

Prepared Graduate 4: Read a wide range of informational texts to build knowledge and to better understand the human experience.

Students interpret blueprints, electrical schematics, plumbing diagrams, manufacturer specifications, installation manuals, safety information, and applicable building codes to install and evaluate residential systems.

Prepared Graduate 5: Understand how language functions in different contexts, command a variety of word-learning strategies to assist comprehension, and make effective choices for meaning or style when writing and speaking.

Students apply plumbing and electrical terminology while interpreting technical documents, following installation procedures, documenting project work, and communicating technical information with instructors and peers.

Prepared Graduate 3 (literary texts) is not directly addressed by this course.

Standard 3: Writing and Composition

Prepared Graduate 7: Craft informational/explanatory texts using techniques specific to the genre.

Students prepare project documentation, installation plans, material lists, inspection records, and technical reports that explain plumbing and electrical installation procedures and project outcomes.

Prepared Graduate 9: Demonstrate mastery of their own writing process with clear, coherent, and error-free polished products.

Students produce organized technical documentation, installation records, project plans, and inspection documentation that accurately communicate installation procedures, code compliance, and completed work.

Prepared Graduate 6 (argument writing) and Prepared Graduate 8 (narrative writing) are not explicitly supported by the course standards.

Standard 4: Research Inquiry and Design

Prepared Graduate 10: Gather information from a variety of sources; analyze and evaluate its quality and relevance; and use it ethically to answer complex questions.

Students research plumbing and electrical codes, manufacturer specifications, material requirements, installation methods, and industry standards to select appropriate materials, ensure code compliance, troubleshoot system issues, and complete safe and effective residential installations.

Note: *Mathematics and Science standards will be added in the future. Visit the [Colorado Academic Standards](#) page for the most current version.*