

Colorado CTE Course – Scope and Sequence

Course Name	Industrial Maintenance		Course Details	Level IV course in the Power, Structure & Technology pathway. This course aligns with content in any of the strands in the pathway		
			Course = 0.50 Carnegie Unit Credit			
Course Description						
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 #	18402	Schedule calculation based on 60 % of instructional time in 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 % of Instructional Time	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration	
Workplace Equipment Safety	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.a. Examine and identify safety hazards associated with equipment, machinery and power units used in AFNR power, structural, and technical systems (e.g., caution, warning, danger, etc.).		
Engine troubleshooting <ul style="list-style-type: none"> Isolation of problem techniques Application of engine operation knowledge to solve issue 	4	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.01. Troubleshoot, service and repair components of internal combustion engines using manufacturers' guidelines.	PST.03.01.01.c. Evaluate service and repair needs for internal combustion engines using a variety of performance tests (e.g., manuals, computer-based diagnostics, etc.).		
Engine maintenance and service intervals <ul style="list-style-type: none"> Identifying & following service recommendations 	2	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.01. Troubleshoot, service and repair components of internal combustion engines using manufacturers' guidelines.	PST.03.01.01.c. Evaluate service and repair needs for internal combustion engines using a variety of performance tests (e.g., manuals, computer-based diagnostics, etc.).		

<p>Equipment manual & use Service intervals & lubrication</p>	<p>3</p>	<p>PST.02.: Operate and maintain AFNR mechanical equipment and power systems.</p> <p>PST.03. Service and repair AFNR mechanical equipment and power systems</p>	<p>PST.02.01. Performance Indicator: Perform preventative maintenance and scheduled service to maintain equipment, machinery and power units used in AFNR settings.</p> <p>PST.03.01. Performance Indicator: Troubleshoot, service and repair components of internal combustion engines using manufacturers' guidelines.</p>	<p>PST.02.01.02.a. Examine operator's manuals to determine recommendations for servicing filtration systems and maintaining fluid levels on equipment, machinery and power units used in AFNR power, structural and technical systems.</p> <p>PST.03.01.02.b. Utilize technical manuals and diagnostic tools to determine service and repair needs of spark-and-compression internal combustion engines used in AFNR power, structural and technical systems.</p>	
<p>Power transmission - Gears pulleys belts chains & PTO drives Pitch, speed ratio, belt profile & types, gear types & applications, adjustments, universal joints, phasing.</p>	<p>4</p>	<p>PST.02. Operate and maintain AFNR mechanical equipment and power systems.</p> <p>PST.03. Service and repair AFNR mechanical equipment and power systems.</p>	<p>PST.02.01. Performance Indicator: Perform preventative maintenance and scheduled service to maintain equipment, machinery and power units used in AFNR settings.</p> <p>PST.03.03. Performance Indicator: Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).</p>	<p>PST.02.01.02.c. Assess and adjust equipment (e.g., belts and drives, chains, sprockets, etc.) and maintain fluid conveyance components (e.g., hoses, lines, nozzles, etc.) to ensure proper functioning.</p> <p>PST.03.03.02.a. Compare and contrast operation principles and features of mechanical transmission systems used in AFNR power, structural and technical systems (e.g., belts, chains, gears, bearings, seals, universals, drive shafts, etc.).</p> <p>PST.03.03.02.b. Utilize speed, torque and power measurements to calculate efficiency in power transmission systems used in AFNR power, structural and technical systems.</p>	

				<p>PST.03.03.02.c. Inspect, analyze and repair the components of power transmission systems used in AFNR power, structural and technical systems.</p>	
<p>Bearings types, lubrication & repair</p>	2	<p>PST.03. Service and repair AFNR mechanical equipment and power systems.</p>	<p>PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).</p>	<p>PST.03.03.02.a. Compare and contrast operation principles and features of mechanical transmission systems used in AFNR power, structural and technical systems (e.g., belts, chains, gears, bearings, seals, universals, drive shafts, etc.).</p> <p>PST.03.03.02.b. Utilize speed, torque and power measurements to calculate efficiency in power transmission systems used in AFNR power, structural and technical systems.</p> <p>PST.03.03.02.c. Inspect, analyze and repair the components of power transmission systems used in AFNR power, structural and technical systems.</p>	
<p>Equipment specific tools, ID, use Dial indicators, feeler indicators, calipers, torque wrench, feeler gage,</p>	2	<p>PST.01. Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.</p>	<p>PST.01.02. Apply physical science and engineering principles to design, implement and improve safe and efficient mechanical systems in AFNR situations.</p>	<p>PST.01.02.03.b. Select, maintain and demonstrate the proper use of tools, machines and equipment used in different AFNR related mechanical systems.</p>	
<p>Types, purpose & operations of clutches, transmissions & final drives</p>	2	<p>PST.03. Service and repair AFNR mechanical equipment and power systems.</p>	<p>PST.03.03. Performance Indicator: Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment</p>	<p>PST.03.03.02.a. Compare and contrast operation principles and features of mechanical transmission systems used in AFNR power, structural and technical systems (e.g., belts,</p>	

			and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	chains, gears, bearings, seals, universals, drive shafts, etc.). PST.03.03.02.c. Inspect, analyze and repair the components of power transmission systems used in AFNR power, structural and technical systems.	
Equipment setup, adjustment & calibration Setup to manual specifications, operation adjustment, critical calibration,	3	PST.02.: Operate and maintain AFNR mechanical equipment and power systems.	PST.02.02. Performance Indicator: Operate machinery and equipment while observing all safety precautions in AFNR settings.	PST.02.02.02.c. Adjust equipment, machinery and power units for safe and efficient operation in AFNR power, structural and technical systems.	
Theory of hydraulic operation - thermodynamic laws	2	PSTS .08 Understand and operate power and mechanical systems for agriculture use PST.03. Service and repair AFNR mechanical equipment and power systems.	PSTS .08.04 Apply theory & operation of hydraulic systems PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	PSTS.08.04.a Understand the theory and principle of operation of hydraulic systems PST.03.03.01.a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.	
Hydraulic vocabulary & terms	1	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	PST.03.03.01.a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.	

<p>Understand basic hydraulic system components & function Pumps, cylinders, flow controls, connectors, hoses, piping, schematics & symbols</p>	<p>3</p>	<p>PST.03. Service and repair AFNR mechanical equipment and power systems.</p>	<p>PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).</p>	<p>PST.03.03.01.a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.</p>	
<p>Hydraulic schematics</p>	<p>2</p>	<p>PST.03. Service and repair AFNR mechanical equipment and power systems.</p>	<p>PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).</p>	<p>PST.03.03.01.b. Analyze and interpret hydraulic and pneumatic system symbols and diagrams used in AFNR power, structural and technical systems.</p>	
<p>Understanding difference between open / closed systems, fixed, variable positive and non positive pumps Identification hydraulic pumps</p>	<p>2</p>	<p>PST.03. Service and repair AFNR mechanical equipment and power systems.</p>	<p>PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).</p>	<p>PST.03.03.01.a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.</p>	
<p>Flow, directional & pressure control valves</p>	<p>1</p>	<p>PST.03. Service and repair AFNR mechanical equipment and power systems.</p>	<p>PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).</p>	<p>PST.03.03.01.a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.</p>	

Hydraulic motors application & design	1	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	PST.03.03.01.a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.	
Hydraulic calculations	2	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	PST.03.03.01.a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.	
Electrical theory & Ohms Law	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.).	
DC current circuits	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.c. Analyze and design electrical circuits for AFNR power, structural and technical systems using knowledge of the basic units of electricity.	
Electrical schematics / diagrams	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.03.02.02.b. Analyze and interpret electrical system symbols and diagrams.	

Electrical motor power systems	3	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.02. Performance Indicator: 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.).	
Electrical components	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.03.02.02.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.).	
Air compressors Pneumatic theory of operation	2	PST.03. Service and repair AFNR mechanical equipment and power systems.	PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment and power source systems (e.g., hydraulic, pneumatic, transmission, steering, suspension, etc.).	PST.03.03.01.a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.	
AC circuits 120 & high voltage	2	PST.04. Plan, build and maintain AFNR structures.	PST.04.04. Performance Indicator: Apply electrical wiring principles in AFNR structures.	PST.04.04.02.a. Distinguish electrical circuits and the components of each.	
AC & DC low voltage control systems	3	PST.04. Plan, build and maintain AFNR structures.	PST.04.04. Performance Indicator: Apply electrical wiring principles in AFNR structures. PST.05.02. Performance Indicator: Prepare and/or use electrical drawings to design, install and troubleshoot electronic	PST.04.04.01.c. Install and/or repair fixtures following appropriate codes and standards. PST.05.02.01.a. Examine and categorize electrical control system components used in AFNR systems (e.g., transistors, relays, HVAC, logic controllers, etc.).	

			control systems in AFNR settings.	<p>PST.05.02.01.b. Analyze schematic drawings for electrical control systems used in AFNR systems.</p> <p>PST.05.02.02.a. Differentiate between the purpose of electrical sensors and controls used in AFNR power, structural and technical systems.</p> <p>PST.05.02.02.b. Interpret maintenance schedules for electrical control systems used in AFNR power, structural and technical systems.</p>	
Sensing devices & PLC	2	<p>PST.04. Plan, build and maintain AFNR structures.</p> <p>PST.05. Use control, monitoring, geospatial and other technologies in AFNR power, structural and technical systems.</p>	<p>PST.04.04. Performance Indicator: Apply electrical wiring principles in AFNR structures.</p> <p>PST.05.01. Apply computer and other technologies (e.g., robotics, CNC, UAS, etc.) to solve problems and increase the efficiency of AFNR systems.</p> <p>PST.05.02. Prepare and/or use electrical drawings to design, install and troubleshoot electronic control systems in AFNR settings.</p>	<p>PST.04.04.01.c. Install and/or repair fixtures following appropriate codes and standards.</p> <p>PST.05.01.01.a. Research and categorize computer technologies used to solve problems and increase efficiency in AFNR systems.</p> <p>PST.05.02.01.a. Examine and categorize electrical control system components used in AFNR systems (e.g., transistors, relays, HVAC, logic controllers, etc.).</p> <p>PST.05.02.01.b. Analyze schematic drawings for electrical control systems used in AFNR systems.</p> <p>PST.05.02.03.a. Research and summarize the importance of</p>	

				<p>AFNR power, structural and technical control systems using programmable logic controllers (PLC) and/or other computer-based systems.</p> <p>PST.05.02.03.b. Assess the functions of AFNR power, structural and technical control systems using programmable logic controllers (PLC) in agricultural production and manufacturing.</p>	
<p>Plumbing component & applications</p>	2	<p>PST.04. Plan, build and maintain AFNR structures.</p>	<p>PST.04.03. Performance Indicator: 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.).</p>	<p>PST.04.03.04.c. Install and/or repair pipes and plumbing equipment and fixtures in AFNR structures.</p>	