

Colorado CTE Course – Scope and Sequence

Course Name	Principles of Ag Power, Structure, and Technical System-A		Course Details	Second course in the Power, Structure & Technical systems pathway / POS. First semester content	
			Course = 0.50 Carnegie Unit Credit		
Course Description	Principles of Ag Power, Structure, and Technical System-A is an introductory course educating students to the basic skills and knowledge in construction and land management. This course covers topics including safety, project management, land site management, irrigation and drainage and agriculture structures and components. Upon completion of this course, proficient students will be prepared for more advanced coursework in agricultural mechanics.				
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 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					
Unit Title and Brief Description	% of Course Instructional Time	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration
Unit 1: Safety in the Workplace Students will demonstrate how to operate shop equipment and machinery safely.	2%	PST 01: Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.	PST 01.02: Apply physical science and engineering principles to design, implement and improve safe and efficient mechanical systems in AFNR situations. SCIENCE: SC.HS.1.6 SC.HS.1.7 SC.HS.1.9	PST 01.02.02.c: Devise and document processes to safely implement and evaluate the safe use of AFNR related tools, machinery and equipment.	
Unit 2: Careers in PSTS	2%	CS.05 Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources career pathways.	CS.05.01 Evaluate and implement the steps and requirements to pursue a career opportunity in each of the AFNR career pathways (e.g. goals, degrees, certifications, resumes, cover letter, portfolio, interview etc.)	CS.05.01.02.a. Examine the educational, training, and experimental requirements to pursue a career in an AFNR pathway (e.g. degrees, certifications, training, internships, etc)	
Welding/Fabrication					

Unit 3: Blueprints / sketches/ bill of materials	4%	PSTs.04 Demonstrate skills in project completion on individual and group projects	PSTS 04.01 Utilize blueprints in completing an agricultural mechanics project	PSTS 04.01.a Student will identify blueprints, their components and describe their purpose	
Unit 4: Proper tool use / ID	2%	PST 01: Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.	PST 01.02: Apply physical science and engineering principles to design, implement and improve safe and efficient mechanical systems in AFNR situations. SCIENCE: SC.HS.1.6 SC.HS.1.7 SC.HS.1.9	PST 01.02.03.b: Select, maintain and demonstrate the proper use of tools, machines and equipment used in different AFNR related mechanical systems.	
Unit 5: Arc Welding processes	1%	PST 01: Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.	PST 01.03: Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).	PST 01.03.01a: Compare and contrast the principles and procedures of different welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).	
Unit 6: Electrode selection & use	1%	PST 01: Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.	PST 01.03: Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).	PST 01.03.02.b: Assess and select the proper electrode for use in various shielded metal arc welding situations.	
Unit 7: striking arc & running bead	7%	PST 01: Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.	PST 01.03: Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).	PST 01.03.01.a: Compare and contrast the principles and procedures of different welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).	

Unit 8: Flat Butt, tee, edge, lap	18%	PST 01: Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.	PST 01.03: Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).	PST 01.03.01.c: Evaluate the quality of metal fabrication procedures (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).	
Unit 9: Equipment & specific safety	2%	PST 01: Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.	PST 01.03: Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).	PST 01.03.01.a: Compare and contrast the principles and procedures of different welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).	
Unit 10: OA skill development Cutting and/or welding as determined by local	5%	PST 01: Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.	PST 01.03: Apply physical science principles to metal fabrication using a variety of welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).	PST 01.03.01.c: Evaluate the quality of metal fabrication procedures (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).	
Technology					
Unit 11: GIS/GPS	1%	PST 05: Use control, monitoring, geospatial and other technologies in AFNR power, structural and technical systems.	PST 05.01: Apply computer and other technologies (e.g., robotics, CNC, UAS, etc.) to solve problems and increase the efficiency of AFNR systems. <u>SCIENCE: SC.ETS.1.3</u> <u>SC.HS.3.9</u>	PST 05.01.01.a Research and categorize computer technologies used to solve problems and increase efficiency in AFNR systems.	
Unit 12: CNC systems	1%	PST 05: Use control, monitoring, geospatial and other technologies in AFNR power, structural and technical systems.	PST 05.01: Apply computer and other technologies (e.g., robotics, CNC, UAS, etc.) to solve problems and increase the efficiency of AFNR systems	PST 05.01.02a: Examine and summarize the specific intent of technologies used to solve problems and increase the efficiency of AFNR	

			<u>SCIENCE:</u> <u>NGSS.SC.ETS.1.3</u> <u>SC.HS.3.9</u>	systems (e.g., robotics, UAS, CNC, etc.).	
Unit 13: CAD design / DXF / CNC relationships	4%	PST 05: Use control, monitoring, geospatial and other technologies in AFNR power, structural and technical systems.	PST 05.01: Apply computer and other technologies (e.g., robotics, CNC, UAS, etc.) to solve problems and increase the efficiency of AFNR systems <u>SCIENCE:</u> <u>NGSS.SC.ETS.1.3</u> <u>SC.HS.3.9</u>	PST 05.01.02.a: Examine and summarize the specific intent of technologies used to solve problems and increase the efficiency of AFNR systems (e.g., robotics, UAS, CNC, etc.).	
Unit 14: Drones & application	1%	PST 05: Use control, monitoring, geospatial and other technologies in AFNR power, structural and technical systems.	PST 05.03: Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems. <u>SCIENCE:</u> <u>SC.HS.3.1</u> <u>NGSS.HS.ETS.1.3</u> <u>SC.HS.3.9</u>	PST 05.03.01.a: Research and summarize the impact of utilizing geospatial technologies (i.e., GPS, GIS, remote sensing, telematics, etc.) in AFNR systems.	
Unit 15: Computer sensing and controls	1%	PST 05: Use control, monitoring, geospatial and other technologies in AFNR power, structural and technical systems.	PST 05.02: Apply computer and other technologies (e.g., robotics, CNC, UAS, etc.) to solve problems and increase the efficiency of AFNR systems.	PST 05.02.03.a: Research and summarize the importance of AFNR power, structural and technical control systems using programmable logic controllers (PLC) and/or other computer-based systems.	
Industrial Maintenance					
Unit 16: Control systems	2%	PST 05: Use control, monitoring, geospatial and other technologies in AFNR power, structural and technical systems.	PST 05.02: Apply computer and other technologies (e.g., robotics, CNC, UAS, etc.) to solve problems and increase the efficiency of AFNR systems.	PST 05.02.01.a: Examine and categorize electrical control system components used in AFNR systems (e.g., transistors, relays, HVAC, logic controllers, etc.).	

Unit 17: Electric motors	2%	PST 04: Plan, build and maintain AFNR structures.	PST 04.04: Apply electrical wiring principles in AFNR structures. <i>SCIENCE: SC.HS.1.8</i>	PST 04.04.02.a: Distinguish electrical circuits and the components of each.	
Unit 18: Drive systems	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 03.03.02.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.).	
Unit 19: Pneumatics	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.	

Colorado CTE Course – Scope and Sequence

Course Name	Principles of Ag Power, Structure, and Technical System-B	Course Details	Second course in the Power, Structure & Technical systems pathway / POS. Second semester content
		Course = 0.50 Carnegie Unit Credit	
Course Description	Principles of Ag Power, Structure, and Technical System-B is an introductory course educating students to the basic skills and knowledge in metal fabrication and agriculture systems. This course covers topics including safety, project management, basic engine and motor mechanics, and basic metal fabrication techniques and processes. Upon completion of this course, proficient students will be prepared for more advanced coursework in agricultural mechanics.		

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Unit Number, Title and Brief Description	% of Course Instructional Time	Competency /Performance Indicator	Outcome / Measurement	CTE or Academic Standard Alignment	CTSO Integration
Unit 1: Careers	2%	CS.05 Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources career pathways.	CS.5.02 Examine and choose career opportunities that are matched to personal skills, talents, and career goals in an AFNR pathway of interest.	CS.05.02.01.b Assess personal skills and align them with potential career opportunities in AFNR pathways.	
Unit 2: Safety	2	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.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.). 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.	
Equipment systems (engine, hydraulic, electrical, mechanical)					
Unit 3: Theory of operation Engines	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.03.01.02.a. Distinguish the characteristics of spark-and-compression internal combustion engines used in AFNR power, structural and technical systems.	
Unit 4: Engine Types and strokes	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.a Identify and classify components of internal combustion engines used in AFNR power, structural and technical systems.	
Unit 5: Engine systems, cooling, lubrication, ignition, fuel	6%	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.b. Analyze and explain how the components of internal combustion engines interrelate during operation.	
Unit 6: Service Manual & Maintenance Scheduling	2%	PST.02. Operate and maintain AFNR mechanical equipment and power systems.	PST.02.01. Perform preventative maintenance and scheduled service to maintain equipment, machinery and power units used in AFNR settings.	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.	
Unit 7: Hydraulic 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.	
Unit 8: Hydraulic system design	5%	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.03.03.01a. Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural and technical systems.	
Unit 9: Hydraulic calculations	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.b. Analyze and interpret hydraulic and pneumatic system symbols and diagrams used in AFNR power, structural and technical systems.	
Unit 10: Hydraulic system components & maintenance	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,	PST.03.03.01.c. Inspect, analyze and repair hydraulic and pneumatic system components used in AFNR power, structural and technical systems.	

			pneumatic, transmission, steering, suspension, etc.).		
Unit 11: Electrical systems	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.03.02.01..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 12: AC /DC circuit	3%	PST.04. Plan, build and maintain AFNR structures.	PST.04.04. Apply electrical wiring principles in AFNR structures. <i><u>SCIENCE: SC.HS.1.8</u></i>	PST.04.04.01.a. Compare and contrast direct and alternating current.	
Construction					
Unit 13: Safety / tool use & ID	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.04.03.03.c. Construct AFNR structures using wood and/or metal materials.	
Unit 14: Building components & design	5%	PST.04. Plan, build and maintain AFNR structures.	PST.04.01. Create sketches and plans for AFNR structures.	PST.04.01.02.a. Read and interpret the parts and/or views of plans for agricultural structures.	
Unit 15: Building materials	2%	PST.04. Plan, build and maintain AFNR structures.	PST.04.03. Follow architectural and mechanical plans to construct, maintain and/or repair AFNR	PST.04.03.01.a. Examine the criteria in selecting materials for constructing,	

			structures (e.g., material selection, site preparation and/or layout, plumbing, concrete/masonry, etc.).	maintaining, and/or repairing AFNR structures.	
Unit 16: Measurement & Layout	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. PST.04.01.01.b. Apply scale measurement and dimension to develop sketches of agricultural structures.	
Unit 17: Plumbing systems & materials	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.).	
Unit 18: Connecting and Joining Plumbing Materials	5%	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.	
Electrical					

Unit 19: Theory of Electricity	1%	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 20: Electrical Conductors & Insulators	1%	PST.04. Plan, build and maintain AFNR structures.	PST.04.04 Apply electrical wiring principles to AFNR structures	PST.04.04.02.a. Distinguish electrical circuits and the components of each.	
Unit 21: Electrical Circuits Types & Uses	1%	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 22: Building Electrical Components and Materials	1%	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 23: Basic circuit wiring	5%	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. PST.04.04.02.c. Plan and wire electrical circuits (i.e., single pole switch,	

				three-way switch, duplex outlet, etc.).	
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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 during laboratory activities and technical projects to safely operate tools and equipment, solve engineering and mechanical problems, and complete tasks involving power, structural, and technical systems.

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

Students communicate technical concepts, engineering solutions, and project outcomes through presentations, demonstrations, and discussions using appropriate technical 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 technical manuals, equipment specifications, engineering drawings, safety procedures, and industry publications to develop knowledge of power, structural, and technical 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 technical vocabulary when interpreting engineering documents, following equipment procedures, documenting laboratory activities, and communicating technical information.

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 laboratory reports, technical documentation, project summaries, and equipment records that explain engineering processes, technical procedures, and project results.

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

Students produce organized technical documentation, project reports, and engineering records that clearly communicate procedures, observations, 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 engineering principles, equipment systems, construction methods, technical specifications, and emerging technologies to design solutions, troubleshoot technical problems, and complete projects involving power, structural, and technical systems.

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