



## Agricultural Mechanics and Fabrication

<b>Course Number</b>	491390
<b>Grade Level</b>	9-12
<b>Career Cluster</b>	Agriculture
<b>Pathway</b>	Agriculture Power, Structural & Technical Systems
<b>Course Sequence</b>	Level 2
<b>CTSO</b>	FFA
<b>Industry Recognized Credential</b>	<a href="https://forms.act.org/certificate/pdf/NCRC-InformationFlyer.pdf">https://forms.act.org/certificate/pdf/NCRC-InformationFlyer.pdf</a> OR <a href="https://www.aws.org/Certification-and-Education/">https://www.aws.org/Certification-and-Education/</a>
<b>Minimum Equipment List</b>	LINK
<b>Course Description</b>	

CIP Codes	CIP Title
1.0201	Agricultural Mechanics and Equipment/Machine Technology
1.0205	Agricultural Power Machinery Technology
1.0303	Agricultural Production Operations, General
15.0613	Manufacturing Engineering Technology/Technician
46.0201	Carpentry/Carpenter
46.0302	Electrician
47.0604	Automobile/Automotive Mechanics Technology/Technician
48.0508	Welding Technology/Welder

SOC Codes	SOC Title
45-2091	Agricultural Equipment Operators
45-2092	Farmworkers and Laborers, Crop, Nursery, and Greenhouse
47-2061	Construction Laborers
47-2111	Electricians
47-2031	Carpenters
49-2098	Security and Fire Alarm Systems Installers
49-3041	Farm Equipment Mechanics and Service Technicians
49-9041	Industrial Machinery Mechanics
51-4121	Welders, Cutters, Solderers, and Brazers



## Course Standards

<b>Agricultural Mechanics and Fabrication</b> <b>Domain 1</b> <b>Examine Career and FFA Opportunities associated with Agricultural Mechanics and Fabrication</b>	
<b>Standard 1.1 Evaluate and implement the steps and requirements to pursue a career opportunity in Agricultural Mechanics.</b>	
Performance Indicators	
1.1.1	Examine the educational, training and experiential requirements to pursue a career in Agricultural Mechanics and Fabrication (e.g., degrees, certifications, training, internships, etc.).
1.1.2	Analyze personal skillset and create a plan for obtaining the required education, training and experiences to obtain a career in Agricultural Mechanics and Fabrication.
<b>Standard 1.2 Assess the opportunities in Agricultural Mechanics available through Career Development Events, Supervised Agricultural Experiences and other FFA activities.</b>	
Performance Indicators	
1.2.1	Evaluate the Agricultural Mechanics and Agricultural Electricity Career Development Events for opportunities to exhibit skills needed in Agricultural Mechanics and Fabrication.
1.2.2	Investigate ways that Agricultural Mechanics and Fabrication skills may be implemented as a Supervised Agricultural Experience and identify other related FFA activities.
<b>Domain 2</b> <b>Apply project management principles and design fundamentals to Agricultural Mechanics and Fabrication applications</b>	
<b>Standard 2.1 Design and plan Agricultural Mechanics and Fabrications projects using industry-standard practices.</b>	
Performance Indicators	
2.1.1	Create comprehensive project plans for agricultural mechanics projects by developing budgets, establishing timelines, identifying safety considerations, and allocating resources effectively to ensure efficient, safe, and successful project completion.
2.1.2	Estimate materials, compute areas, volumes, and angles, and perform other necessary mathematical computations to fabricate and assemble components precisely in construction and fabrication projects.



2.1.3	Develop itemized material lists and cost estimates for agricultural construction or fabrication projects by accurately determining material quantities, applying current industry pricing, and using spreadsheet software to organize and calculate total project costs efficiently.
<b>Standard 2.2 Use CAD software and read technical drawings to design and build agricultural structures</b>	
Performance Indicators	
2.2.1	Demonstrate the use of computer-aided design (CAD) software to create accurate project plans, scaled technical drawings, and layouts for agricultural structures and equipment, applying design principles and industry standards to guide fabrication and construction.
2.2.2	Read and interpret blueprints, technical drawings, and specifications for agricultural structures and equipment, applying this information to accurately plan, measure, and calculate dimensions using geometry, fractions, ratios, and unit conversions.
<b>Standard 2.3 Analyze project requirements to formulate solutions for construction and fabrication tasks.</b>	
Performance Indicators	
2.3.1	Compare and contrast applications of simple machines in agricultural mechanical systems.
2.3.2	Identify and select appropriate tools, machines, and equipment (e.g., welders, cutting torches, plasma cutters, grinders, drill presses, and hand tools) needed to construct and fabricate agricultural mechanics projects, to demonstrate the ability to match equipment to specific materials, processes, and project requirements.
2.3.3	Analyze project requirements to determine optimal design solutions within given parameters and constraints.
<b>Domain 3</b> <b>Demonstrate basic metalworking and fabrication skills for Agricultural Mechanics and Fabrication applications</b>	
<b>Standard 3.1 Apply welding principles and procedures using multiple welding processes.</b>	
Performance Indicators	
3.1.1	Compare and contrast the principles, procedures, and applications of different welding processes, including SMAW (stick), GMAW (MIG), and oxy-fuel welding.
3.1.2	Demonstrate safe setup and operation of welding equipment (e.g., SMAW or GMAW) by selecting appropriate settings, preparing materials, and following safety procedures to perform basic fabrication projects in agricultural structures and equipment.
3.1.3	Produce quality welds using appropriate welding processes (e.g., SMAW, GMAW, or FCAW) for specific agricultural applications and materials, including fillet welds, groove welds, lap joints, butt joints, and T-joints.
3.1.4	Inspect and evaluate weld quality on agricultural structures and equipment by applying visual inspection techniques, identifying defects (e.g., undercut, porosity, and cracks), and ensuring compliance with industry standards (AWS) to guarantee structural integrity.



**Standard 3.2 Perform metal cutting and material preparation operations safely and accurately.**

Performance Indicators

3.2.1	Compare and contrast metal cutting processes including oxy-fuel cutting, plasma cutting, and mechanical cutting methods.
3.2.2	Demonstrate safe operation of cutting equipment (e.g., oxy-fuel torches, plasma cutters, and angle grinders) by following proper setup and operational procedures, including adjusting regulators, setting correct cutting speeds, maintaining a stable cutting path, and practicing fire safety and PPE use to ensure accurate and safe material preparation in agricultural mechanics.
3.2.3	Select and apply appropriate cutting methods (e.g., oxy-fuel cutting, plasma cutting, or mechanical cutting) based on material type, thickness, and intended application, demonstrating the ability to choose correct equipment, adjust settings, and produce accurate cuts for agricultural projects.

**Standard 3.3 Select and work with materials used in Agricultural Mechanics and Fabrication applications.**

Performance Indicators

3.3.1	Compare and contrast properties of different metals used in agricultural power, structural, and technical systems, including malleability, conductivity, and chemical composition.
3.3.2	Select and apply appropriate materials for agricultural applications by evaluating environmental conditions, load requirements, durability, and cost factors, ensuring safe, functional, and cost-effective structures and equipment.

**Domain 4**  
**Demonstrate basic operation and maintenance of engines, motors, and mechanical systems**

**Standard 4.1 Identify and service components of internal combustion engines used in agriculture.**

Performance Indicators

4.1.1	Identify and classify components of internal combustion engines used in agricultural power systems.
4.1.2	Compare and contrast the characteristics and applications of two-cycle engines, four-cycle engines, and electric motors.
4.1.3	Explain and demonstrate the theory of operation for internal combustion engines by analyzing and applying knowledge of fuel delivery, ignition, lubrication, and cooling systems to diagnose issues and ensure proper function in agricultural equipment.
4.1.4	Perform basic maintenance procedures on small engines (e.g., checking and changing oil, replacing filters, inspecting spark plugs, and adjusting carburetors) by following manufacturer specifications and safety procedures to ensure reliable and efficient operation in agricultural equipment.



<b>Standard 4.2 Troubleshoot and diagnose problems in engines and mechanical systems.</b>	
Performance Indicators	
4.2.1	Demonstrate systematic troubleshooting procedures to identify and diagnose common engine, mechanical, and electrical system problems (e.g., fuel delivery issues, worn components, or faulty wiring) using diagnostic tools, inspection techniques, and logical problem-solving methods to restore proper operation in agricultural equipment.
4.2.2	Use appropriate diagnostic tools and techniques (e.g., multimeters, compression gauges, spark tester, and visual inspection methods) to identify and troubleshoot malfunctions in engines and agricultural equipment, ensuring accurate diagnosis and effective repair.
4.2.3	Recommend and select appropriate power sources and equipment (e.g., gasoline, diesel, electric, or power transfer systems) based on performance requirements and intended agricultural applications.
4.2.4	Recommend and select appropriate power sources and equipment (e.g., gasoline, diesel, electric, or power transfer systems) based on material compatibility and intended agricultural applications.
<b>Standard 4.3 Examine basic electrical principles and applications in Agricultural Mechanics and Fabrication.</b>	
Performance Indicators	
4.3.1	Compare and contrast basic units of electricity (e.g., volts, amps, watts, and ohms) in relation to small engines, explaining their relationships and how voltage, current, and resistance affect engine performance, circuit function, and overall electrical system operation in agricultural equipment.
4.3.2	Use electrical measuring instruments (e.g., multimeters and voltmeters) to test, measure, and diagnose electrical circuits and components, demonstrating the ability to identify faults, verify proper operation, and ensure safe and reliable performance in agricultural equipment.
4.3.3	Compare and contrast direct current (DC) and alternating current (AC) applications in agricultural systems, analyzing their characteristics, advantages, and appropriate uses in equipment (e.g., battery-powered machinery, motors, generators, and irrigation systems), to determine the most effective power source for specific tasks.
<b>Domain 5</b>	
<b>Plan, design, and construct basic Agricultural structures using appropriate materials and techniques</b>	
<b>Standard 5.1 Read and interpret plans for agricultural structures and create material specifications.</b>	
Performance Indicators	
5.1.1	Determine structural requirements for agricultural construction projects by analyzing load capacities, materials, and design specifications, and prepare accurate cost estimates by calculating material quantities, labor, and industry pricing to ensure efficient, safe, and budget-conscious project planning.
5.1.2	Prepare bills of materials, cut list, and step by step procedures for agricultural projects by accurately determining required materials, using correct units and measurements, applying current industry pricing, and calculating total project costs to ensure efficient budgeting and resource planning.



<b>Standard 5.2 Select appropriate materials and apply construction principles for agricultural structures.</b>	
Performance Indicators	
5.2.1	Evaluate, compare, and select construction materials (e.g., wood, metal, concrete, and composites) based on their strength, durability, cost, and suitability, and apply proper fabrication and installation techniques to construct safe and functional agricultural structures.
5.2.2	Select and apply appropriate plumbing materials (e.g., copper, PVC, or PEX) based on their characteristics, durability, and suitability.
5.2.3	Demonstrate proper installation techniques for water systems in agricultural structures, ensuring functional and code-compliant agricultural water delivery.
5.2.4	Identify and evaluate components, properties, and characteristics of concrete and masonry materials (e.g., cement, aggregates, mortar, and reinforcing elements) used in agricultural construction, demonstrating the ability to select appropriate materials for durability, load-bearing capacity, and project requirements.
<b>Standard 5.3 Construct basic agricultural structures following plans and safety procedures.</b>	
Performance Indicators	
5.3.1	Demonstrate proper material selection, site preparation, and layout procedures for agricultural construction projects.
5.3.2	Apply basic construction principles (e.g., wood framing, concrete pouring and finishing, and metal fabrication techniques) by using proper tools, following safety procedures, and ensuring structural integrity and accuracy in agricultural construction projects.
5.3.3	Plan, organize, and execute agricultural construction projects by following architectural and mechanical plans, applying proper construction techniques, using appropriate tools and equipment, and maintaining safety standards to produce functional, durable, and code-compliant structures.
<b>Standard 5.4 Apply electrical wiring principles in agricultural structures</b>	
Performance Indicators	
5.4.1	Compare and contrast direct current (DC) and alternating current (AC) in agricultural applications, analyzing their characteristics, advantages, and appropriate uses in structures, equipment, and machinery to determine the most effective power source for specific agricultural systems.
5.4.2	Assess and analyze the electrical requirements of agricultural structures (e.g., barns, greenhouses, or equipment sheds) by evaluating load demands, circuit needs, and safety considerations, ensuring that electrical systems are properly designed, efficient, and code-compliant for agricultural applications.
5.4.3	Distinguish between different types of electrical circuits (e.g., series, parallel, and combination circuits) identify their components (e.g., switches, outlets, lighting, and power sources), and calculate voltage, current, and resistance using Ohm's Law and circuit analysis techniques, demonstrating the ability to design, analyze, and apply proper electrical systems in agricultural structures, buildings, and equipment installations.



<b>Domain 6</b>	
<b>Apply surveying techniques and precision technologies in Agricultural Mechanics and Fabrication applications</b>	
<b>Standard 6.1 Perform basic surveying and land measurement operations.</b>	
Performance Indicators	
6.1.1	Set up, operate, and take down basic surveying instruments (e.g., levels, transits, and measuring tapes) to accurately measure distances, elevations, and angles, applying these measurements to plan and lay out agricultural construction and land management projects safely and efficiently.
6.1.2	Document, organize, and analyze measurements and observations in field notes or reports, using the information to make accurate decisions for land planning, construction layout, and agricultural project implementation.
<b>Standard 6.2 Examine geospatial and precision technologies used in Agricultural systems.</b>	
Performance Indicators	
6.2.1	Research and summarize the impact of Geographic Information Systems (GIS), Global Positioning Systems (GPS), and remote sensing technologies in agricultural applications.
6.2.2	Explain how agricultural enterprises employ GIS and GPS technologies for precision agriculture, including data acquisition and spatial analysis.
6.2.3	Evaluate the benefits and economic impacts of precision agriculture technologies on agricultural efficiency and productivity.
<b>Standard 6.3 Apply computers and technologies to solve Agricultural Mechanics and Fabrication problems.</b>	
Performance Indicators	
6.3.1	Research and categorize computer technologies used to solve problems and increase efficiency in agricultural systems.
6.3.2	Examine technologies, including robotics, CNC machinery, and unmanned aircraft systems (UAS) for agricultural applications.

**Contributors**

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