

Introduction to Power, Structural, and Technical Systems

8016 36 weeks

Table of Contents

Acknowledgments..... 1

Course Description..... 2

Task Essentials Table..... 2

Curriculum Framework..... 5

SOL Correlation by Task 42

FFA Information 45

Green Building Infusion Units 46

Entrepreneurship Infusion Units 46

Appendix: Credentials, Course Sequences, and Career Cluster Information 47

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Course Description

Suggested Grade Level: 9 or 10 or 11 or 12

This introductory course prepares students for careers in agricultural mechanics, fabrication, and construction. Students receive hands-on experience with the operation, maintenance, and repair of agricultural equipment. Other experiences will include the use of tools and equipment for agricultural structures, electricity, welding, and carpentry.

As noted in [Superintendent's Memo #058-17 \(2-28-2017\)](#), this Career and Technical Education (CTE) course must maintain a maximum pupil-to-teacher ratio of 20 students to one teacher, due to safety regulations. The 2016-2018 biennial budget waiver of the teacher-to-pupil ratio staffing requirement does not apply.

Task Essentials Table

8016	Tasks/Competencies
+	Identify the role of supervised agricultural experiences (SAEs) in agricultural education.
+	Participate in an SAE.
+	Identify the benefits and responsibilities of FFA membership.
+	Describe leadership characteristics and opportunities as they relate to agriculture and FFA.
○	Apply for an FFA degree and/or an agricultural proficiency award.
+	Apply safety instructions and practices when using tools and equipment.
+	Identify all major tools and equipment and their applications.

<input checked="" type="radio"/>	Explain the proper use, storage, and disposal of oils, grease, and chemicals.	
<input checked="" type="radio"/>	Identify marked safety areas.	
<input checked="" type="radio"/>	Identify the location and use of eye wash stations.	
<input checked="" type="radio"/>	Identify the location of the posted evacuation routes.	
<input checked="" type="radio"/>	Locate and demonstrate knowledge of safety data sheets (SDS).	
<input checked="" type="radio"/>	Demonstrate the safe use of chemicals.	
<input checked="" type="radio"/>	Demonstrate the safe use of standard and metric hand tools.	
<input checked="" type="radio"/>	Demonstrate the safe use of power tools.	
<input checked="" type="radio"/>	Demonstrate the safe use of precision standard and metric measuring tools.	
<input checked="" type="radio"/>	Demonstrate the safe use of protective clothing and equipment.	
<input checked="" type="radio"/>	Demonstrate the safe use of fire protection equipment.	
<input checked="" type="radio"/>	Demonstrate the safe use of equipment.	
<input checked="" type="radio"/>	Demonstrate safe practices in the agricultural mechanics lab/workshop.	
<input checked="" type="radio"/>	Identify alternative energy sources.	
<input type="radio"/>	Research alternative fuels.	
<input checked="" type="radio"/>	Describe proper operation of agricultural machinery and equipment.	
<input checked="" type="radio"/>	Explain safe highway operation of agricultural machinery.	
<input checked="" type="radio"/>	Conduct pre- and/or post-operation inspection of tractor and equipment.	
<input type="radio"/>	Conduct daily service and care of tractor and equipment.	
<input type="radio"/>	Explain how to safely connect an attachment and/or implement.	
<input checked="" type="radio"/>	Research technologies used in precision agricultural management.	
<input type="radio"/>	Explain the procedure for operating a GPS receiver.	
<input type="radio"/>	Demonstrate the ability to collect data and apply that data in developing a map.	
<input checked="" type="radio"/>	Describe the basic operating principles of an internal combustion engine.	
<input checked="" type="radio"/>	Explain the differences between a two-stroke and a four-stroke engine.	
<input checked="" type="radio"/>	Explain the differences between gasoline and diesel engines.	

<input checked="" type="radio"/>	Explain the function and operating principles of the power train and its components.	
<input type="radio"/>	Discriminate between power take-off (PTO) systems.	
<input type="radio"/>	Explain the operation of final drives.	
<input type="radio"/>	Explain the operation of planetary gears.	
<input type="radio"/>	Explain the operation of inboard and outboard brakes.	
<input type="radio"/>	Troubleshoot drive system components.	
<input checked="" type="radio"/>	Identify the application of hydraulics in agriculture.	
<input type="radio"/>	Explain the components of a hydraulic system.	
<input checked="" type="radio"/>	Explain the application of safety switches on agricultural machines.	
<input checked="" type="radio"/>	Explain the application of electricity in agricultural equipment.	
<input type="radio"/>	Identify pipe fittings by type.	
<input type="radio"/>	Assemble plastic pipe.	
<input checked="" type="radio"/>	Identify materials for concrete construction.	
<input checked="" type="radio"/>	Calculate the quantity and cost of materials for a job.	
<input type="radio"/>	Mix concrete on the job site.	
<input type="radio"/>	Place concrete in forms.	
<input type="radio"/>	Finish concrete slabs.	
<input checked="" type="radio"/>	Determine the percent of slope.	
<input checked="" type="radio"/>	Determine land area.	
<input checked="" type="radio"/>	Use plans and working drawings.	
<input checked="" type="radio"/>	Figure a bill of materials.	
<input checked="" type="radio"/>	Use carpentry tools and measuring instruments.	
<input checked="" type="radio"/>	Apply construction fasteners.	
<input type="radio"/>	Prepare and apply finish to wood.	
<input checked="" type="radio"/>	Describe electrical energy and how it works.	
<input checked="" type="radio"/>	Define common electrical terms and their relationships.	

<input checked="" type="radio"/>	Connect receptacles, switches, and fixtures for a given circuit.
<input type="radio"/>	Install branch circuits.
<input checked="" type="radio"/>	Follow safe practices in arc welding.
<input checked="" type="radio"/>	Identify types of electrodes, filler rods, and fluxes.
<input checked="" type="radio"/>	Prepare equipment and materials for welding.
<input type="radio"/>	Identify metals.
<input checked="" type="radio"/>	Perform a welding operation.
<input checked="" type="radio"/>	Identify safe practices for metal striking and machine tools.
<input checked="" type="radio"/>	Lay out and drill holes, using a twist drill.
<input checked="" type="radio"/>	Use metal files and metal cutting tools.
<input type="radio"/>	Determine tap drill sizes.
<input type="radio"/>	Cut threads with tap and die.
<input type="radio"/>	Identify safe practices for using keen edge tools and grinding equipment.
<input type="radio"/>	Sharpen common tools.
<input type="radio"/>	Identify appropriate shapes and angles of cutting edges for wood and metal cutting tools.

Legend: Essential Non-essential Omitted

Note: Competencies 39-43 have been added to ensure compliance with federal legislation: National FFA Organization's Federal Charter Amendments Act (Public Law 116-7, <https://www.congress.gov/116/plaws/publ7/PLAW-116publ7.pdf>). All inquiries may be sent to cte@doe.virginia.gov. Students are provided opportunities for leadership, personal growth, and career success. Instruction is delivered through three major components: classroom and laboratory instruction, supervised agricultural experience (SAE) program, and student leadership (FFA).

Curriculum Framework

Task Number 39

Identify the role of supervised agricultural experiences (SAEs) in agricultural education.

Definition

Identification should include

- defining an SAE program as *an opportunity for students to consider multiple careers and occupations in the agriculture, food, and natural resources (AFNR) industries, learn expected workplace behavior, develop specific skills within an industry, and apply academic and occupational skills in the workplace or a simulated workplace environment*
- researching the Foundational SAE
 - career exploration and planning
 - personal financial planning and management
 - workplace safety
 - employability skills for college and career readiness
 - agricultural literacy
- researching the Immersion SAE
 - entrepreneurship/ownership
 - placement/internships
 - research (experimental, analytical, invention)
 - school business enterprises
 - service learning
- developing a plan to participate in an SAE, based on personal and career goals
- researching available awards and degrees, based on SAE participation.

Teacher resource: [SAE Resources](#), National Council for Agricultural Education

Process/Skill Questions

- What are examples of SAEs related to this course and in the AFNR industries?
- Where can a copy of the Virginia SAE Record Book be found?
- What is an Immersion SAE?
- How does a placement/internship SAE differ from an ownership/entrepreneurship SAE?
- How does an SAE provide relevant work experience and contribute to the development of critical thinking skills?
- How is the SAE an extended individualized instructional component of a student's Career Plan of Study?
- How can an SAE be used to provide evidence of student growth and participation in authentic, work-related tasks?
- What are the four types of SAEs?
- What are the advantages of participating in work-based learning experiences and projects?
- How does one choose an appropriate SAE in which to participate?

Task Number 40

Participate in an SAE.

Definition

Participation should include

- developing, completing, or continuing a plan to participate in an SAE as a work-based learning experience, based on personal and career goals
- documenting experience, connections, positions held, and competencies attained, using the *Virginia SAE Record Book*
- researching available awards and degrees, based on SAE participation.

Teacher resources:

[FFA SAE](#)

[The Agricultural Experience Tracker](#)

Process/Skill Questions

- What are the advantages of participating in work-based learning experiences and projects?
- How do SAEs help prepare students for the workforce?
- What are some examples of SAEs in AFNR?

Exploring Leadership Skills and FFA Membership

Task Number 41

Identify the benefits and responsibilities of FFA membership.

Definition

Identification should include

- benefits
 - listing opportunities to participate in community improvement projects and career development events (CDEs) and leadership development events (LDEs)
 - exploring leadership development opportunities
- responsibilities
 - researching the responsibilities of FFA officers, committees, and members
 - locating resources that guide participation in FFA activities
 - explaining the FFA Creed, Motto, Salute, and mission statement
 - explaining the meaning of the FFA emblem, colors, and symbols

- explaining significant events and the history of the organization.

Process/Skill Questions

- How does one become an FFA member?
- What is the FFA's mission and how does it accomplish its mission?
- What are the benefits and responsibilities of FFA membership?
- What five FFA activities are available through the local chapter?
- What are some significant events in FFA history? How have these events shaped membership over time?
- What is the FFA program of activities (POA), and how is it used?

Task Number 42

Describe leadership characteristics and opportunities as they relate to agriculture and FFA.

Definition

Description should include

- examples of successful leaders
- types of leadership
 - autocratic
 - participative
 - laissez-faire
 - servant
 - followership
- positive leadership qualities and traits of successful leaders
- opportunities for participating in leadership activities in FFA
- demonstrating methods for conducting an effective meeting.

Process/Skill Questions

- Who are some successful leaders in the agriculture industry?
- What qualities make a successful leader?
- What are leadership traits?
- What is the difference between positive and negative leadership?

Task Number 43

Apply for an FFA degree and/or an agricultural proficiency award.

Definition

Application should include

- identifying types of FFA degrees
 - Greenhand
 - Chapter
 - State
 - American
- identifying proficiency award areas
 - entrepreneurship
 - placement
 - combined
 - agriscience research
- exploring CDEs and LDEs related to this course
- identifying all SAE criteria to be eligible for the award
- identifying the type of award
- applying for an FFA award.

Teacher resource: [FFA Agricultural Proficiency Awards](#)

Process/Skill Questions

- Where are the awards and their application criteria located?
- What are the benefits of winning an FFA award?
- What are the benefits and requirements of an FFA degree?
- What FFA awards are available?
- How does the FFA degree program reward FFA members in all phases of leadership, skills, and occupational development?
- What is the highest degree that can be conferred upon an FFA member at the national level?
- What are the requirements for a Greenhand FFA degree?

Identifying Tools and Equipment

Task Number 44

Apply safety instructions and practices when using tools and equipment.

Definition

Application should include

- instruction on the safe operation and use of tools and equipment
- safety test for each specific type of tool or machine(s)
- use of personal protective equipment (PPE).

Process/Skill Questions

- Who regulates safety in the workplace?
- What is PPE?
- Why are symbols used for the operation of equipment?
- Where can the safety rules for using equipment at school be found?

Task Number 45

Identify all major tools and equipment and their applications.

Definition

Identification should include, but not be limited to, the tools required to complete activities in the agricultural mechanics lab/workshop.

Process/Skill Questions

- What are the ways that tools are powered?
 - How are tools classified?
-

Task Number 46

Explain the proper use, storage, and disposal of oils, grease, and chemicals.

Definition

Explanation should include guidelines to meet the requirements set by the Occupational Safety and Health Administration (OSHA) and the National Fluid Power Association (NFPA) and the importance of the information on labels instruction on safety data sheet (SDS).

Process/Skill Questions

- What makes a material hazardous?
- What is an SDS, and where should it be located?
- What is the importance of an SDS?
- What do the symbols on the side of a chemical container represent?
- How should flammable liquids be stored?
- What information should be on the label of a hazardous material?

Applying Safety Practices in the Agricultural Mechanics Lab/Workshop

Task Number 47

Identify marked safety areas.

Definition

Identification should include describing and translating signage and special markings (e.g., floor paint) that identify work and caution areas.

Process/Skill Questions

- What are the different types of work zones?
- How do you know if additional safety equipment or clothing is needed to enter a safety area?
- How are walkways identified in the lab/workshop area?

Task Number 48

Identify the location and use of eye wash stations.

Definition

Identification should include describing the signage and operating procedures for the unit.

Process/Skill Questions

- What is the color of the sign that signifies an eye wash station?
- When should you use an eye wash station?
- What safety equipment provides additional eye protection?

Task Number 49

Identify the location of the posted evacuation routes.

Definition

Identification should include

- events that could trigger an evacuation
- the location and interpretation of the posted evacuation route
- the destination and procedures for evacuation.

Process/Skill Questions

- What route should be followed in the event of an evacuation?
 - Where is the evacuation route posted?
 - Why is it important to establish a meeting place in the case of an evacuation?
-

Task Number 50

Locate and demonstrate knowledge of safety data sheets (SDS).

Definition

Demonstration should include identifying

- the location of the sheets within the agricultural mechanics lab/workshop and the purpose they serve
- the administration's (ownership's) responsibility for workers' health and safety
- laws/regulations and practices affecting workers' health and safety
- health and safety hazards
- health and safety programs the responsibility for environmental stewardship
- environmental laws, regulations, and practices
- sustainability initiatives.

Process/Skill Questions

- What environmental concerns should an industry address?
- What environmentally friendly practices and resources are available to an industry?
- What methods can be used to motivate employees to become involved in effective health, safety, and environmental practices?

Task Number 51

Demonstrate the safe use of chemicals.

Definition

Demonstration should include the different types of solvents, soaps, cleaning solutions, fuel, oils, greases, specialty additives, and gasses.

Demonstration should also emphasize the correct use, the hazards, and the precautions associated with each, in accordance with manufacturers' instructions and government regulations.

Process/Skill Questions

- Why is it important to read the manufacturer's directions when using chemicals?
- What may be the effects of using chemicals incorrectly?

- Where should chemicals be stored within the lab/workshop?
- What is an SDS?

Task Number 52

Demonstrate the safe use of standard and metric hand tools.

Definition

Demonstration should include the various types of hand tools (including specialty tools, fasteners, and measuring tools) used in agricultural mechanics. Demonstration should emphasize the correct use, the hazards, the precautions, and the maintenance procedures associated with each, in accordance with manufacturers' instructions and government regulations. Hand tools should include

- common end wrenches
- various socket set components
- various wrenches
- various screwdrivers
- various styles of pliers
- various hammers
- various punches and chisels
- specialty cutting tools (e.g., hack saw, tubing cutter, hand reamer, file)
- specialty electrical system tools (e.g., volt/ohmmeter, dwell/tachometer, continuity light, timing light, remote starter switch)
- battery specialty tools (e.g., cable puller, terminal and post cleaner, battery lifting or carrying strap)
- lubrication specialty tools (e.g., transmission funnel, oil filter-removing tool, grease gun)
- other miscellaneous specialty tools (e.g., air nozzles, C-clamp, puller set, pressure gauge, screw extractor).

Process/Skill Questions

- Why is it important to use the proper hand tool for each job?
- When a wrench is used, why should it always be pulled toward the body?
- Why is it necessary to keep hand tools clean and free of grease?

Task Number 53

Demonstrate the safe use of power tools.

Definition

Demonstration should include the various types of power tools (including pneumatic and electric tools) encountered in agricultural mechanics.

Demonstration should emphasize the correct use, the hazards, the precautions, and the maintenance procedures

associated with each, in accordance with manufacturers' instructions and government regulations. Power tools should include

- air impact gun
- air hammer
- air ratchet
- air drill
- drop light
- electric drill
- electric grinder.

Process/Skill Questions

- What is the purpose of a dead man switch and/or kill switch on power tools? What is the purpose of an emergency stop (e-stop) or emergency power off (EPO) on power tools?
 - When should adjustments be made to power tools?
 - Why is training on the use of a power tool necessary before using it?
-

Task Number 54

Demonstrate the safe use of precision standard and metric measuring tools.

Definition

Demonstration should include micrometers, dial indicators, torque wrenches, and other manufacturers' specialty tools.

Process/Skill Questions

- How does heat affect the micrometer?
 - Why are standard and quality tools necessary when repairing agricultural machinery and equipment?
 - What is torque? Why is proper torque important?
-

Task Number 55

Demonstrate the safe use of protective clothing and equipment.

Definition

Demonstration should include the types of protective clothing and equipment (e.g., protection of the eyes, respiratory system, auditory functions, feet, hands, and body) and grooming/hygiene (e.g., precautions related to hair length; loose clothing/jewelry; greasy hands, shoes, or clothing; dirty or scratched eye protection).

Demonstration should include the correct use, the hazards, and the precautions associated with each, in accordance with manufacturers' instructions and government regulations concerning hazardous material and lab safety.

Process/Skill Questions

- What hazards exist due to loose-fitting clothing or long hair?
 - When is it advisable to use goggles in an agricultural mechanics lab/workshop?
 - Would it ever be necessary to wear ear protection in an agricultural mechanics lab/workshop?
 - Why are steel-toed boots and shoes worn in agricultural mechanics labs/workshops?
-

Task Number 56

Demonstrate the safe use of fire protection equipment.

Definition

Demonstration should include

- different types of fires encountered in the agricultural science and mechanics field (Class A, B, C, and D)
- appropriate types of extinguishers to use with each fire
- hazards and the precautions associated with each
- fire emergency procedures that follow government regulations and instructor's guidelines.

Process/Skill Questions

- What are the different types of fire extinguishers?
 - Is the fire extinguisher in your lab/workshop appropriate for all types of fires? Explain.
 - What procedure should students follow in case of an emergency or accident?
-

Task Number 57

Demonstrate the safe use of equipment.

Definition

Demonstration should include the different types of equipment used in the agricultural mechanics field, along with the correct use, the hazards, and the precautions associated with each, in accordance with manufacturer's specifications and instructor's guidelines. Equipment should include

- pneumatic equipment (e.g., tire machine, pneumatic jack)

- hydraulic equipment (e.g., floor jack, lift rack, hydraulic press, engine hoist)
- electrical equipment (e.g., bench grinder, drill press, battery testers and chargers).

Process/Skill Questions

- What are unsafe uses of air compressors in the agricultural lab/workshop?
 - What is the safest way to hold a part in a vise?
 - When is the cleaning tank used?
-

Task Number 58

Demonstrate safe practices in the agricultural mechanics lab/workshop.

Definition

Demonstrating safe practices must include

- passing written tests with 100% accuracy on
 - general lab/workshop safety
 - safety and operating procedures for all tools, equipment, and machinery
 - the major parts of all tools, equipment, and machinery
- passing a proficiency/performance test with 100% accuracy for all tools, equipment, and machinery
- following manufacturer's instructions and reviewing safety manuals, when applicable
- following all safety guidelines and procedures when using tools, equipment, and machinery in the agricultural mechanics lab/workshop
- selecting appropriate personal protective equipment (PPE) for the operation of concern
- following the safety standards and regulations of the U.S. Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), the Equipment and Engine Training Council (EETC) Education Committee, and Safety Data Sheets (SDS).

Process/Skill Questions

- What information should be sent with emergency responders to the hospital with the student if a chemical is splashed in an eye or wound?
 - Are state and national safety standards followed in school labs/workshops? Explain.
 - What agency requires labs/workshops and businesses to use the services of companies such as Safety Clean?
 - What are the dangers of running an engine in a confined space without proper ventilation?
 - Why is it important to achieve 100% accuracy on tests regarding safety and operating procedures before using tools, equipment, and machinery?
-

Exploring Alternative Energies

Task Number 59

Identify alternative energy sources.

Definition

Identification should include

- geothermal energy
- solar energy
- nuclear power
- atom
- wind
- water
- biodiesel
- ethanol
- biomass
- methane.

Process/Skill Questions

- What structural and design components can be implemented with each type of alternative energy?
- What are local alternative energy sources?
- What considerations can be made in improving agricultural structures?

Task Number 60

Research alternative fuels.

Definition

Research should include

- geothermal energy
- solar energy
- nuclear power
- atom
- wind
- water
- biodiesel
- ethanol

- biomass
- methane.

Process/Skill Questions

- What is the difference between a fossil fuel and an alternative fuel?
 - How are alternative fuels produced compared to conventional fuels?
-
-

Orienting Students to Proper Agricultural Machinery and Equipment Safety and Operation

Task Number 61

Describe proper operation of agricultural machinery and equipment.

Definition

Description should include

- complying with the National Agricultural Safety Database (NASD)
- identifying danger zones
- understanding warning labels and signs
- following all safety guidelines and procedures for machinery and equipment
- generating an emergency action plan.

Process/Skill Questions

- What is the purpose of rollover protective structures (ROPS)?
- What is the purpose of a guard?
- Why are safety switches important?
- What piece of equipment is involved in most farm accidents?

Task Number 62

Explain safe highway operation of agricultural machinery.

Definition

Explanation should include

- highway rules and regulations, according to NASD or the Virginia Department of Transportation (VDOT)
- universal hand signals
- entering traffic
- lighting/warning systems
- stopping distance
- equipment stability at highway speeds
- travel time difference between automobiles and agricultural machinery and/or equipment
- traffic signs.

Process/Skill Questions

- What is an SMV sign, and what does it mean?
- Why are the brake pedals locked together when operating farm machinery on the highway?
- What are the differences between traffic laws for automobiles and agricultural equipment?
- What are the requirements for a person who is going to operate farm machinery on public roads and highways?
- Why is it important to ensure all caution lighting systems are operational prior to highway use?

Task Number 63

Conduct pre- and/or post-operation inspection of tractor and equipment.

Definition

Conducting inspection should include

- fluid levels
- air pressure
- brake adjustments
- clutch adjustments
- safety equipment
- broken or worn parts
- loose parts
- visibility
- lights and electrical
- hoses and belts.

Process/Skill Questions

- What would occur if the different fluid levels were low during operation?
- Why should safety switches never be bypassed?
- What determines whether a part needs to be replaced?
- What is the importance of a pre-operation inspection? Post-operation inspection?

Task Number 64

Conduct daily service and care of tractor and equipment.

Definition

Conducting daily service should include checking

- applicable filters
- tire pressure
- bolt tightness
- grease and lubrication
- cleanliness
- equipment or machinery operator's manual guidelines
- emissions requirements.

Process/Skill Questions

- What is a service schedule, and why is it important?
- What is the importance of servicing the tractor? Equipment?

Task Number 65

Explain how to safely connect an attachment and/or implement.

Definition

Explanation should include

- following the instructions and recommendations of the equipment manufacturer according to the operator's manual
- hitching to three-point hitch systems, drawbar, loader, and quick attachment.

Process/Skill Questions

- What is the purpose of a top link?
- What safety concerns are there with hitching an implement improperly?
- What is the purpose of quick-attach systems, and where are they found?

Understanding Precision Agricultural Management

Task Number 66

Research technologies used in precision agricultural management.

Definition

Research should include

- new technologies in land mapping
- global positioning system (GPS)
- self-steer systems on farm machinery
- computer-guided systems
- unmanned aerial vehicles (UAVs)
- data management.

Process/Skill Questions

- What new precision technologies are available in agriculture production that were not available five years ago?
- What does GPS stand for, and how does it get its signal?

Task Number 67

Explain the procedure for operating a GPS receiver.

Definition

Explanation should include how to use a hand-held GPS unit to plot points, measure distances, and calculate area.

Process/Skill Questions

- What are the steps to determine the area of a field in acres?
- How has precision technology helped to make production agriculture more efficient?

Task Number 68

Demonstrate the ability to collect data and apply that data in developing a map.

Definition

Demonstration should include

- plotting points
- determining distance

- calculating area, using specific given points at a location.

Process/Skill Questions

- What is the procedure for developing a map of a given area?
- How is area calculated?

Identifying Fundamentals of Engines

Task Number 69

Describe the basic operating principles of an internal combustion engine.

Definition

Description should include

- the theory of operation
- the components of combustion
- the five events (i.e., intake, compression, ignition, power, exhaust).

Process/Skill Questions

- What are the three components of combustion?
- Why is the timing of each event important?

Task Number 70

Explain the differences between a two-stroke and a four-stroke engine.

Definition

Explanation should include fuel mixture lubrication system events and how they occur in each type of engine.

Process/Skill Questions

- Why does oil have to be mixed with fuel for a two-stroke engine?
- How many piston movements does it take to complete all processes in a two-stroke engine?
- How many degrees does the crankshaft turn on a four-stroke engine to complete all five events?
- What are the advantages and disadvantages of a four-stroke engine compared to a two-stroke engine?

Task Number 71

Explain the differences between gasoline and diesel engines.

Definition

Explanation should include

- how ignition occurs in each engine
- how the engines are constructed
- differences in operation
- octane vs. cetane.

Process/Skill Questions

- What causes the fuel to ignite in a diesel engine?
- What are the differences between gasoline and diesel?
- What takes the place of spark plugs in a diesel engine?

Identifying Fundamentals of Drive Systems

Task Number 72

Explain the function and operating principles of the power train and its components.

Definition

Explanation should include

- the different types of clutches (e.g., dry vs. wet)
- the operation of clutches
- the operation of transmissions
- the operation of final drives
- the operation of planetary gears
- the operation of inboard and outboard brakes.

Process/Skill Questions

- What is the purpose of a clutch on a machine?
- What are the different types of clutches?

Task Number 73

Discriminate between power take-off (PTO) systems.

Definition

Discrimination should include 540 revolutions per minute (rpm) vs. 1000 rpm and how to tell the difference.

Process/Skill Questions

- How can it be determined whether a tractor is equipped with a 540 rpm or a 1000 rpm PTO?
- What are the advantages and disadvantages of a transmission-driven PTO? Live PTO?
- What is an example of using a 540 rpm PTO? A 1000 rpm PTO?

Task Number 74

Explain the operation of final drives.

Definition

Explanation should include how the final drive transfers power and provides torque.

Process/Skill Questions

- How do final drives increase torque?
- What is the purpose of the final drive?

Task Number 75

Explain the operation of planetary gears.

Definition

Explanation should include how planetary gears increase torque or speed and should also include gear ratios.

Process/Skill Questions

- How do planetary gears work together?
- What is a gear ratio?

Task Number 76

Explain the operation of inboard and outboard brakes.

Definition

Explanation should include different types of machinery with each type of brake system.

Process/Skill Questions

- What are the advantages and disadvantages of each type of brake system?
- What is an example of a machine with inboard brakes? Outboard brakes?

Task Number 77

Troubleshoot drive system components.

Definition

Troubleshooting should include

- evaluation
- analysis
- diagnosis.

Process/Skill Questions

- What is the most common cause of drive system failure?
 - What is the most common cause of hydraulic system failure?
-
-

Identifying the Fundamentals of Hydraulics

Task Number 78

Identify the application of hydraulics in agriculture.

Definition

Identification should include different methods of

- lifting
- steering
- braking
- moving

on various components.

Process/Skill Questions

- How have hydraulics made things easier in the agriculture industry?
- What types of machinery use hydraulics?

Task Number 79

Explain the components of a hydraulic system.

Definition

Explanation should include types of

- pumps
- valves
- cylinders
- safety lockout systems.

Process/Skill Questions

- What is the difference between an open-center system and closed-center system?
- What is the purpose of a control valve?
- How do relief valves work?
- How does a hydraulic cylinder operate?

Understanding Agricultural Machinery Electrical Systems

Task Number 80

Explain the application of safety switches on agricultural machines.

Definition

Explanation should include

- codes and requirements for safety switches
- how safety switches work
- importance of including lockout switches and warning switches.

Process/Skill Questions

- What is the purpose of a safety switch?
- Where would a safety switch on an agricultural machine be located?

Task Number 81

Explain the application of electricity in agricultural equipment.

Definition

Explanation should include

- difference between AC and DC current
- application of electricity and its function.

Process/Skill Questions

- What components on machines use electricity?
- How can it be determined whether the agricultural machine uses AC or DC current?

Completing Plumbing Practices for Agricultural Structures

Task Number 82

Identify pipe fittings by type.

Definition

Identification might include

- iron
- copper
- polyethylene (PE)
- cross-linked polyethylene (PEX)
- polyvinyl chloride (PVC)
- chlorinated polyvinyl chloride (CPVC)
- union
- no hub band
- coupling
- 90 degree
- 45 degree
- street elbow

- "T"
- "Y"
- bushing
- cap
- plug.

Process/Skill Questions

- What is the difference between male and female threads?
 - What are the advantages of the different types of plumbing materials?
 - What are the disadvantages of the different types of plumbing materials?
-

Task Number 83

Assemble plastic pipe.

Definition

Assembly should include the use of multiple types of pipe with different types of fittings.

Process/Skill Questions

- What types of pipe should not be used for hot water?
 - Why is it important to clean the pipe before assembly?
-
-

Conducting Concrete and Masonry Practices for Agricultural Structures

Task Number 84

Identify materials for concrete construction.

Definition

Identification should include

- concrete

- sand
- gravel
- strengthening materials.

Process/Skill Questions

- What is the purpose of the different concrete materials?
 - What determines the strength of the concrete materials?
-

Task Number 85

Calculate the quantity and cost of materials for a job.

Definition

Calculation may be based on

- a small project or a footer
- foundation
- slab

using a mathematical formula.

Process/Skill Questions

- What information is needed to calculate the quantity and cost of materials?
- What is the standard unit of measurement for concrete?

Task Number 86

Mix concrete on the job site.

Definition

Mixing may include using

- a mixer
- a wheel barrow
- a bucket
- a mixing trough.

Process/Skill Questions

- What is the importance of mixing concrete?
- What determines the proportions of the material used to mix concrete?

- What is the difference between a 3,000-pound mix and a 3,500-pound mix?
-

Task Number 87

Place concrete in forms.

Definition

Placement may include

- stepping stones
- mailbox posts
- sidewalks.

Process/Skill Questions

- Why does concrete need to be vibrated?
 - What is the purpose of the concrete form?
-

Task Number 88

Finish concrete slabs.

Definition

Finishing should include using different tools, including a float, finishing trowel, and edger.

Process/Skill Questions

- What is the difference between a smooth finish and a broom finish?
 - What is the procedure for getting a smooth finish on a concrete slab?
-
-

Leveling and Measuring Land for Agricultural Structures

Task Number 89

Determine the percent of slope.

Definition

Determination could include the use of

- transit level
- block level
- line ruler

to find the percentage slope.

Process/Skill Questions

- How is slope determined?
- Where is it important to determine slope?

Task Number 90

Determine land area.

Definition

Determination should include using various measuring manuals and/or electronic tools methods (e.g., tape measure, hand-held GPS, pacing) to calculate the area in acres.

Process/Skill Questions

- How many square feet are in an acre?
- For what operations is the land area needed?
- What is the importance of ground truthing electronic measurements?

Conducting Carpentry Practices for Agricultural Structures

Task Number 91

Use plans and working drawings.

Definition

Use may include

- identifying and selecting equipment and supplies for drawing
- drawing views of objects and landscaping plans
- drawing a laboratory project plan
- exploring computer-aided design (CAD) programs
- interpreting symbols for electrical, plumbing, and welding.

Process/Skill Questions

- What views of objects can be drawn?
- What are the steps in drawing an object?
- What is the purpose of a project plan?
- What CAD programs are used in agribusiness?
- What are the advantages of using CAD programs?

Task Number 92

Figure a bill of materials.

Definition

Figuring should include calculating board feet, fasteners, metal, welding rods, and hardware.

Process/Skill Questions

- Why is a bill of materials important?
 - How is lumber sold?
 - How is metal sold?
 - How are fasteners sold?
 - How does it affect your budget when you only need a small quantity of something only sold in large quantities?
 - What are the different types of fasteners for wood and metal?
 - What are the steps in estimating a bill of materials?
-

Task Number 93

Use carpentry tools and measuring instruments.

Definition

Use may include

- reading a ruler with graduations in standard and metric units
- calculating volume and area
- using conversion factors (e.g., fractions to decimals, pints to quarts, feet to meters)
- using calculations of basic decimals and fractions
- using layout tools, including framing square, speed square, try square, hammer, and different saws.

Process/Skill Questions

- What is the difference between the metric and English system of measurement?
 - What are the uses of the different types of squares?
 - What are the types of hammers? Saws?
 - How is the center point on a piece of stock located?
 - What is the importance of understanding the use of different tools?
-

Task Number 94

Apply construction fasteners.

Definition

Application of a variety of construction fasteners should include

- types of adhesives
- types and classes of nails, bolts, and screws

and how and when to use each type, depending on the project.

Process/Skill Questions

- What determines the difference between types of glue?
 - How are bolts classified?
 - What determines the type of nail to be used?
 - How are screws sized?
 - What are the advantages and disadvantages of using nails? Screws?
-

Task Number 95

Prepare and apply finish to wood.

Definition

Preparation should include

- choosing the type of finish (e.g., acrylic or latex paint, enamel, lacquer, polyurethane)
- choosing the appropriate sandpaper
- sanding the wood.

Application should include

- rub on
- brush
- spray.

Process/Skill Questions

- What determines when oil- or water-based finishes should be used?
 - What is meant by the grit of sandpaper?
-
-

Performing Electrical Operations for Agricultural Structures

Task Number 96

Describe electrical energy and how it works.

Definition

Description should include explanation of

- volts, amps, and watts
- how to calculate current usage
- Ohm's law
- how electricity is produced
- how electricity is made available for the consumer.

Process/Skill Questions

- What is the correlation between volts and amps?
- How is current measured? Sold?
- What is the purpose of a transformer?
- How does resistance affect a circuit?

Task Number 97

Define common electrical terms and their relationships.

Definition

Definitions may include

- *voltage*
- *amperage*
- *watts*
- *resistance*
- *ohms*
- *ground fault circuit interrupter (GFCI)*
- *transformer*
- *generator*
- *receptacle*
- *duplex*
- *switch*
- *ground*
- *continuity*
- *gauge*
- *fixture*
- *conductor*
- *neutral.*

Process/Skill Questions

- Why is it important to know the names of common electrical components?
- What is the purpose of a GFCI in a circuit?
- How is wire sized?
- What is the purpose of the neutral?

Task Number 98

Connect receptacles, switches, and fixtures for a given circuit.

Definition

Connection should include identifying the proper way to connect wires to a

- single-poled switch
- light fixture
- duplex receptacle
- three-way switches
- GFCI.

Process/Skill Questions

- What is the purpose of each wire in a circuit?

- What safety precautions should be used before connecting any electrical wire?

Task Number 99

Install branch circuits.

Definition

Installation may include

- a breaker in a service panel
- switches
- receptacles
- light fixtures

to meet local electrical code.

Process/Skill Questions

- Why should an electrical code be followed?
- What are the steps in wiring a branch circuit in a home?
- What determines the load that can be placed on each branch circuit?

Performing Metal Fabrication Operations for Agricultural Structures

Task Number 100

Follow safe practices in arc welding.

Definition

Following safe practices should include

- using personal protective equipment PPE
- avoiding hazards
- following all recommended safety guidelines and procedures.

Process/Skill Questions

- What is the purpose of a welding helmet?
- What shade lenses should be used for arc welding?

- What is meant by a "flash" in welding?

Task Number 101

Identify types of electrodes, filler rods, and fluxes.

Definition

Identification may include

- general production rods
 - E6010
 - E6011
 - E6013
 - E7014
 - E7018
 - E7024
- classification by the AWS classification system.

Process/Skill Questions

- What does the "E" mean?
 - How is MIG wire classified?
 - What number reveals the tensile strength of a weld made by an electrode?
-

Task Number 102

Prepare equipment and materials for welding.

Definition

Preparation should include

- inspecting welding leads and holders for safety
- getting metal ready by filing, grinding, removing paint, or using a wire brush.

Process/Skill Questions

- Why is metal preparation important to ensure a good weld?
 - How does the electrode selection affect the way the metal is prepared?
 - Why are frayed welding leads a hazard?
-

Task Number 103

Identify metals.

Definition

Identification should include

- physical properties from low to high
 - carbon steel
 - types of cast iron
 - ferrous and nonferrous metals.

Process/Skill Questions

- What determines the hardness of metal?
 - What is the difference between ferrous and nonferrous metal?
 - How are the types of carbon steel identified?
 - How are the types of cast iron identified?
-

Task Number 104

Perform a welding operation.

Definition

Performance should include using provided welding equipment to perform various welding operations.

Process/Skill Questions

- What determines the rate of travel?
 - What are the signs of a good weld?
-
-

Performing Cold Metal Work for Agricultural Structures

Task Number 105

Identify safe practices for metal striking and machine tools.

Definition

Identification should include

- proper clothing (e.g., safety glasses, gloves, face shield)
- proper care and tool-fitting procedures.

Process/Skill Questions

- How is the proper angle to sharpen a specific tool determined?
- What parts of the body need to be protected when using a striking tool?
- What is the result of using a dull tool?

Task Number 106

Lay out and drill holes, using a twist drill.

Definition

Laying out and drilling holes should include

- measuring the marking
- center punching metal
- selecting the correct bit.

Process/Skill Questions

- What determines the size of bit to use when drilling a hole in metal?
 - What is the purpose of center punch marking before drilling?
-

Task Number 107

Use metal files and metal cutting tools.

Definition

Use should include

- identifying types of files
- selecting appropriate file (e.g., size, shape, degree of coarseness, tooth geometries)

- using a file, following all safety guidelines and procedures
- cleaning a file (e.g., with a file card)
- drawing light cross and heavy cross filing techniques.

Process/Skill Questions

- What is the difference between a single- and double-cut file?
 - What determines the type of file to use for a specific operation?
-

Task Number 108

Determine tap drill sizes.

Definition

Determination should include

- using a tap and drill chart
- determining the type of threads (e.g., NPT, UNF, UNC, metric).

Process/Skill Questions

- What determines the type of threads that are needed?
 - Why is the size of drill so important for getting good threads?
-

Task Number 109

Cut threads with tap and die.

Definition

Cutting should include using various tap and die handles and types of metal.

Process/Skill Questions

- Why is it important to bevel the end of the rod?
 - What is the purpose of the lubricant?
 - What determines whether the threads are long enough?
-
-

Reconditioning Tools

Task Number 110

Identify safe practices for using keen edge tools and grinding equipment.

Definition

Identification should include instruction and demonstration of using the proper clothing and equipment.

Process/Skill Questions

- What precautions should be used when using keen edge tools and grinders?
- What PPE should be worn?

Task Number 111

Sharpen common tools.

Definition

Sharpening may include the following tools:

- wood chisel
- cold chisel
- center punch
- axe
- hatchet
- twist drill bit

Process/Skill Questions

- What is the advantage of keeping tools sharp?
 - Which is more dangerous, a sharp tool or a dull tool? Explain.
-

Task Number 112

Identify appropriate shapes and angles of cutting edges for wood and metal cutting tools.

Definition

Identification may include constructing a tool sharpening template or using a sliding T bevel.

Process/Skill Questions

- Why is it important to ensure that a tool is sharpened to the correct angle?
- Can metal cutting tools be used on wood? Why, or why not?

SOL Correlation by Task

39	Identify the role of supervised agricultural experiences (SAEs) in agricultural education.	English: 9.3, 9.5, 10.3, 10.5, 11.3, 11.5, 12.3, 12.5
40	Participate in an SAE.	English: 9.5, 9.8, 10.5, 10.8, 11.5, 11.8, 12.5, 12.8
41	Identify the benefits and responsibilities of FFA membership.	English: 9.5, 9.6, 9.7, 9.8, 10.5, 10.6, 10.7, 10.8, 11.5, 11.6, 11.7, 11.8, 12.5, 12.6, 12.7, 12.8
42	Describe leadership characteristics and opportunities as they relate to agriculture and FFA.	English: 9.5, 10.5, 11.5, 12.5 History and Social Science: VUS.8, VUS.9, VUS.10, VUS.11, WHII.8, WHII.10, WHII.11
43	Apply for an FFA degree and/or an agricultural proficiency award.	English: 9.5, 10.5, 11.5, 12.5
44	Apply safety instructions and practices when using tools and equipment.	English: 9.5, 10.5, 11.5, 12.5 History and Social Science: GOVT.16
45	Identify all major tools and equipment and their applications.	
46	Explain the proper use, storage, and disposal of oils, grease, and chemicals.	English: 9.5, 10.5, 11.5, 12.5 History and Social Science: GOVT.16 Science: CH.1b
47	Identify marked safety areas.	
48	Identify the location and use of eye wash stations.	
49	Identify the location of the posted evacuation routes.	
50	Locate and demonstrate knowledge of safety data sheets (SDS).	English: 9.5, 10.5, 11.5, 12.5
51	Demonstrate the safe use of chemicals.	Science: CH.1
52	Demonstrate the safe use of standard and metric hand tools.	
53	Demonstrate the safe use of power tools.	
54	Demonstrate the safe use of precision standard and metric measuring tools.	

55	Demonstrate the safe use of protective clothing and equipment.	
56	Demonstrate the safe use of fire protection equipment.	
57	Demonstrate the safe use of equipment.	
58	Demonstrate safe practices in the agricultural mechanics lab/workshop.	English: 9.5, 10.5, 11.5, 12.5 History and Social Science: GOVT.16 Science: CH.1
59	Identify alternative energy sources.	Science: PH.7a
60	Research alternative fuels.	English: 9.5, 9.8, 10.5, 10.8, 11.5, 11.8, 12.5, 12.8 Science: PH.4a
61	Describe proper operation of agricultural machinery and equipment.	English: 9.5, 10.5, 11.5, 12.5 History and Social Science: GOVT.16
62	Explain safe highway operation of agricultural machinery.	English: 9.5, 10.5, 11.5, 12.5 History and Social Science: GOVT.16
63	Conduct pre- and/or post-operation inspection of tractor and equipment.	History and Social Science: GOVT.16
64	Conduct daily service and care of tractor and equipment.	History and Social Science: GOVT.16
65	Explain how to safely connect an attachment and/or implement.	English: 9.5, 10.5, 11.5, 12.5 History and Social Science: GOVT.16
66	Research technologies used in precision agricultural management.	English: 9.5, 9.8, 10.5, 10.8, 11.5, 11.8, 12.5, 12.8 History and Social Science: VUS.14
67	Explain the procedure for operating a GPS receiver.	English: 9.5, 10.5, 11.5, 12.5 Mathematics: G.14
68	Demonstrate the ability to collect data and apply that data in developing a map.	Science: PH.1c
69	Describe the basic operating principles of an internal combustion engine.	English: 9.5, 10.5, 11.5, 12.5 Science: PH.4a
70	Explain the differences between a two-stroke and a four-stroke engine.	English: 9.5, 10.5, 11.5, 12.5 Science: PH.4a
71	Explain the differences between gasoline and diesel engines.	English: 9.5, 10.5, 11.5, 12.5 Science: PH.4a
72	Explain the function and operating principles of the power train and its components.	English: 9.5, 10.5, 11.5, 12.5 Science: PH.4a
73	Discriminate between power take-off (PTO) systems.	English: 9.5, 10.5, 11.5, 12.5

		Science: PH.4a
74	Explain the operation of final drives.	English: 9.5, 10.5, 11.5, 12.5 Science: PH.4a
75	Explain the operation of planetary gears.	English: 9.5, 10.5, 11.5, 12.5 Science: PH.7a
76	Explain the operation of inboard and outboard brakes.	English: 9.5, 10.5, 11.5, 12.5 Science: PH.4a
77	Troubleshoot drive system components.	
78	Identify the application of hydraulics in agriculture.	Science: PH.4a
79	Explain the components of a hydraulic system.	English: 9.5, 10.5, 11.5, 12.5 Science: PH.4a
80	Explain the application of safety switches on agricultural machines.	English: 9.5, 10.5, 11.5, 12.5 Science: PH.4a
81	Explain the application of electricity in agricultural equipment.	English: 9.5, 10.5, 11.5, 12.5 History and Social Science: VUS.8 Science: PH.11c
82	Identify pipe fittings by type.	
83	Assemble plastic pipe.	
84	Identify materials for concrete construction.	
85	Calculate the quantity and cost of materials for a job.	Mathematics: A.1
86	Mix concrete on the job site.	
87	Place concrete in forms.	
88	Finish concrete slabs.	
89	Determine the percent of slope.	Mathematics: A.6
90	Determine land area.	Mathematics: A.6
91	Use plans and working drawings.	English: 9.5, 10.5, 11.5, 12.5 Science: PH.1b, PH.1g
92	Figure a bill of materials.	
93	Use carpentry tools and measuring instruments.	
94	Apply construction fasteners.	
95	Prepare and apply finish to wood.	
96	Describe electrical energy and how it works.	English: 9.5, 10.5, 11.5, 12.5 Science: PH.7a, PH.11c
97	Define common electrical terms and their relationships.	English: 9.3, 9.5, 10.3, 10.5, 11.3, 11.5, 12.3, 12.5
98	Connect receptacles, switches, and fixtures for a given circuit.	Science: PH.11c

99	Install branch circuits.	History and Social Science: GOVT.16 Science: PH.11c
100	Follow safe practices in arc welding.	English: 9.5, 10.5, 11.5, 12.5 History and Social Science: GOVT.16
101	Identify types of electrodes, filler rods, and fluxes.	
102	Prepare equipment and materials for welding.	
103	Identify metals.	
104	Perform a welding operation.	
105	Identify safe practices for metal striking and machine tools.	History and Social Science: GOVT.16
106	Lay out and drill holes, using a twist drill.	
107	Use metal files and metal cutting tools.	
108	Determine tap drill sizes.	
109	Cut threads with tap and die.	
110	Identify safe practices for using keen edge tools and grinding equipment.	History and Social Science: GOVT.16
111	Sharpen common tools.	
112	Identify appropriate shapes and angles of cutting edges for wood and metal cutting tools.	Mathematics: G.3, G.13, G.14

FFA Information

The National FFA is an organization dedicated to preparing members for leadership and careers in the science, business, and technology of agriculture. Local, state, and national activities and award programs provide opportunities to apply knowledge and skills acquired through agriculture education.

For additional information about the student organization, see the [National FFA website](#) and the [Virginia FFA Association website](#).

The following leadership development events are available for this course:

- [Agricultural Issues](#)
- [Employment Skills](#)
- [Extemporaneous Public Speaking](#)
- [Parliamentary Procedure](#)
- [Prepared Public Speaking](#)

The following career development events are available for this course:

- [Agricultural Communications](#)
- [Agricultural Sales](#)
- [Agronomy](#)
- [Agricultural Technology & Mechanical Systems](#)
- [Dairy Cattle Evaluation and Management](#)
- [Environmental & Natural Resources](#)
- [Farm and Agribusiness Management](#)

- [Floriculture](#)
- [Food Science and Technology](#)
- [Forestry](#)
- [Horse Evaluation](#)
- [Marketing Plan](#)
- [Meats Evaluation and Technology](#)
- [Nursery/Landscape](#)
- [Poultry Evaluation](#)
- [Veterinary Science](#)

Green Building Infusion Units

[*The Green Building Infusion Unit \(GBIU\)*](#) was designed to encourage teachers to infuse instructional units on green building knowledge and skills into designated CTE courses. The infusion unit is not mandatory, and, as such, the tasks/competencies are marked as “optional,” to be taught at the instructor’s discretion.</p></div>

Entrepreneurship Infusion Units

Entrepreneurship Infusion Units may be used to help students achieve additional, focused competencies and enhance the validated tasks/competencies related to identifying and starting a new business venture. Because the unit is a complement to certain designated courses and is not mandatory, all tasks/competencies are marked “optional.”

46

Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- Agricultural Systems Technology I Examination
- Agriculture Mechanics Assessment
- College and Work Readiness Assessment (CWRA+)
- Customer Service Specialist (CSS) Examination
- EETC Technician Certification Tests
- Master Service Technician Examinations
- National Career Readiness Certificate Assessment
- Power Equipment Technology Examination
- Small Engine Technology Assessment
- Workplace Readiness Skills for the Commonwealth Examination

Concentration sequences: *A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.*

- Agricultural Business Fundamentals I (8022/36 weeks)
- Agricultural Business Management III (8026/36 weeks)
- Agricultural Business Operations II (8024/36 weeks)
- Agricultural Fabrication and Emerging Technologies (8019/36 weeks)
- Agricultural Power Systems (8018/36 weeks)
- Agricultural Power Systems, Advanced (8020/36 weeks)
- Agricultural Production Technology (8010/36 weeks)
- Agricultural Structural Systems (8017/36 weeks)
- Applied Agricultural Concepts (8072/18 weeks)
- Applied Agricultural Concepts (8073/36 weeks)
- Energy and Power (8495/18 weeks)
- Foundations of Agriculture, Food, and Natural Resources (8006/36 weeks)
- Livestock Production Management (8012/36 weeks)
- Operating the Farm Business (8014/36 weeks)
- Small Engine Repair (8021/18 weeks)
- Small Engine Repair (8082/36 weeks)
- Turfgrass Management (8051/36 weeks)
- Turfgrass Management, Advanced (8054/36 weeks)

Career Cluster: Agriculture, Food and Natural Resources	
Pathway	Occupations
Plant Systems	Machine Setter, Operator
Power, Structural, and Technical Systems	Agricultural Engineer Agricultural Equipment Operator Agricultural Equipment Parts Manager Agricultural Equipment Parts Salesperson Machinist Parts Manager Welder

Career Cluster: Science, Technology, Engineering and Mathematics

Pathway	Occupations
Engineering and Technology	Agricultural Engineer Civil Engineer Civil Engineering Technician Electrical Engineer Electrical Engineering Technician Engineer Engineering Technician Industrial Engineer Industrial Engineering Technician Manufacturing Systems Engineer Mechanical Engineer Mechanical Engineering Technician Power Systems Engineer