WELDING/SMALL GAS ENGINES

COURSE DESCRIPTION: Welding/Small Gas Engines is designed to introduce students to the fundamentals of agricultural mechanics focusing on welding and small gas engines. Students learn basic terminology used in the agricultural mechanics industry, safe work practices, agricultural tools and metal skills.

Welding/Small Gas Engines is a shop/laboratory oriented course that emphasizes basic knowledge and application of shop safety rules and proper uses of tools and materials. SMAW, MIG, TIG, oxyacetylene welding and cutting skills, and principles of small gas engines are learned. Skill and age-appropriate projects are constructed to give students opportunities to apply agricultural mechanics principles. Welding/Small Gas Engines also includes agricultural leadership and employability skills.

Approved June 2018

Major Topic (Unit)	Concepts	Time	The Students will know: (Essential Questions)	Skills	Assessment	Standards
Shop/ Welding Safety	1. Shop Safety 2. Welding Safety	1 Week	1. Identify physical hazards that are common to welding and cutting equipment. 2. Identify use of personal protective equipment for welding and cutting operations. 3. Identify fire hazards and methods of fire. 4. Explain the hazards involved with welding fumes and gases. 5. Identify welding fume ventilation methods. 6. Explain the effects of electricity and precautions used to prevent injury	- Identify Safe practices - Identify & demonstrate safe and appropriate dress for welding	- General shop safety test - Quizzes & Tests	1.1.2.1 1.1.2.2 1.1.2.3

Tool/ Equipment ID	1. Tool Identification 2. Welding Equipment Identification	1 Week	1. Describe safety precautions for welding hand tools. 2. Identify clamping tools and their uses. 3. Identify cutting tools and their uses. 4. Describe and demonstrate the safe operation of bench and pedestal grinders, angle and straight grinders. 5. Describe and demonstrate the use and safe operation of portable power drills, drill presses and twist drills. 6. Identify and describe the procedures for cutting metals using shearing machines, power cut-off saws, and metal-cutting band saws.	- Identify welding tools and equipment - Identify the uses of welding tools and equipment	- Tool Identification test/quiz	1.1.4.1 1.1.4.2 1.1.4.4 1.1.5.1
Welding Joints & Positions	1. Types of welds 2. Uses of various welds	1 Week	1. Identify the five basic joints. 2. Describe the types of welds and their uses. 3. Identify joint and weld type variations. 4. Outline the major considerations to be accounted for in the	- Identify various welding joints - Identify uses for each joint	- Quizzes & Tests	1.1.2.1 1.1.2.2 1.1.5.1 1.1.5.4

			design of a joint for welding			
Basic SMAW Welding	1. Define SMAW Welding 2. Examine SMAW welding practices 3. Demonstration of SMAW Welding	3 Week	1. Define SMAW related terms. 2. Describe AC-DC generator welding power sources. 3. Identify the effect of arc length, speed, voltage and amperage on a weld 4. Successfully demonstrate how to SMAW weld basic joints	- Basic SMAW Welding - SMAW equipment set-up and maintenance	- ARC Welding Quiz - ARC welding skills grade - Employability grade	1.1.2.1 1.1.2.2 1.1.5.1 1.1.5.3 1.1.5.4
Intro to GTAW Welding	1. Define GTAW Welding 2. Examine GTAW welding practices 3. Demonstration of GTAW Welding	2 Week	1. Describe the GTAW process and applications. 2. Describe advantages and disadvantages of the GTAW process. 3. Explain the hazards and protective measures associated with GTAW. 4. Describe the torch assembly. 5. Successfully demonstrate how to GTAW weld basic joints.	- Basic GTAW welding - GTAW equipment set-up and maintenance	- GTAW Welding Quiz - GTAW welding skills grade - Employability grade	1.1.2.1 1.1.2.2 1.1.5.1 1.1.5.3 1.1.5.4
Intro to GMAW Welding	1. Define GMAW Welding 2. Examine GMAW welding practices	2 Week	1. Describe the principles of operation of GMAW.	- Basic GMAW welding - GMAW equipment set-	- GMAW Welding Quiz	1.1.2.1 1.1.2.2 1.1.5.1 1.1.5.3

	3. Demonstration of GMAW Welding		2. Identify the components of a basic GMAW set-up. 3. Describe GMAW power sources and wire feeders. 4. Identify advantages and disadvantages of GMAW. 5. Identify the precautions you must take against electrical shock, toxic fumes and radiant energy associated with GMAW. 6. Successfully demonstrate how to SMAW weld basic joints	up and maintenance	- GMAW welding skills grade - Employability grade	1.1.5.4
Basic Oxyacetylene Welding	1. Proper use of oxyacetylene equipment 2. Demonstrate safe oxyacetylene welding skills.	2 Week	1. Describe the characteristics and handling procedures for oxygen and fuel gases. 2. Describe the use, care and maintenance of oxy-fuel equipment components. 3. Explain the recommended procedure for placement, set-up and shutting down the equipment.	- Basic oxyacetylene welding skills - Oxyacetylene equipment setup and maintenance	- Oxyacetylene Welding Quiz - Oxyacetylene welding skills grade - Employability grade	1.1.2.1 1.1.2.2 1.1.5.1 1.1.5.2 1.1.5.3 1.1.5.4

			4. Describe pressure and flame adjustments 5. Demonstrate safe oxy-acetylene welding			
Basic Oxyacetylene Cutting	1. Proper use of oxyacetylene equipment 2. Demonstrate oxyacetylene cutting skills	1 Week	1. Demonstrate the ability to safely operate a hand-held oxy-fuel cutting torch on available plate and structural shapes. 2. Perform straight line, bevel, and cutting on available mild steel. 3. Pierce and cut holes in mild steel plate. 4. Demonstrate the ability to safely operate an oxy-fuel cutting machine torch on available plate	- Basic oxyacetylene cutting skills - Oxyacetylene equipment setup and maintenance	- Oxyacetylene cutting Quiz - Oxyacetylene cutting skills grade - Employability grade	1.1.2.1 1.1.2.2 1.1.5.1 1.1.5.2 1.1.5.3 1.1.5.4
Plasma Cutting	1. Proper use and care of plasma cutting equipment 2. Plasma cutting skills	1 Week	1. Demonstrate the ability to safely operate a plasma cutter 2. Perform straight line, bevel and cutting on available steel. 3. Describe the use, care and maintenance of plasma cutting equipment components. 4. Explain the recommended procedure for placement, set-up and	- Basic plasma cutting skills - Plasma cutting equipment setup and maintenance	- Plasma cutting Quiz - Plasma cutting skills grade - Employability grade	1.1.2.1 1.1.2.2 1.1.5.1 1.1.5.4

			shutting down the equipment.			
Careers in Welding	1. Careers in welding 2. Post-secondary opportunities in welding	1 Week	1. Examine the various career opportunities in welding 2. Examine post-secondary educational and work opportunities 3. Identify the advantages and disadvantages of a career in the welding industry	- Identification of welding careers	- Tests and Quizzes - Welding Career project	1.1.3.1 1.1.3.2
Reading Blueprints/ Bill of Materials	1. How to use a welding blueprint. 2. Shop mathematics.	1 Week	1. Determine how to read, use and make a welding project blueprint 2. Review shop mathematics including fractions and decimals.	- Reading a blueprint - Creating a bill of materials - Shop mathematics	- Tests and Quizzes - Blueprint project	1.1.2.1 1.1.2.2 1.1.5.1 1.1.5.2 1.1.5.3 1.1.5.4
Final Welding Project	1. Completion of assigned welding project	3 Week	(Complete a pre-determined welding project assigned my instructor) 1. Create a bill of materials & determine overall cost of project 2. Choose correct equipment and consumables	- Skills learned all semester will be used to complete final project	- Welding Project	1.1.2.1 1.1.2.2 1.1.5.1 1.1.5.2 1.1.5.3 1.1.5.4
Shop/Engine Safety	1. Shop Safety 2. Small gas engine safety	1 Week	1. What safety equipment is supplied in the shop?	- Identify Safe practices - Identify & demonstrate safe and	- General shop safety test - Quizzes & Tests	1.1.2.1 1.1.2.2 1.1.2.3

			2. What are the exits used in case of a fire? 3. What safety has to be learned regarding the equipment in the shop? 4. What is the proper dress for safe work when working with small gas engines	appropriate dress for working on small gas engines		
Tool & Engine Part ID	1. Tool Identification 2. Small gas engine Equipment Identification	1 Week	1. Describe safety precautions for small gas engines hand tools. 2. Describe and demonstrate the safe operation of wrenches, sockets, screwdrivers, pliers. 3. Describe and demonstrate the use of a micrometer. 4. Identify the main parts of a four stroke engine and their purposes.	- Identify small gas engine tools and equipment - Identify the uses of small gas engine tools and equipment	- Tool Identification test/quiz	1.1.2.1 1.1.2.2 1.1.6.1 1.1.6.2
Disassembly	1. Engine disassembly 2. How to use engine manual	3 Week	1. How to disassemble a four stroke cycle engine. 2. How to test the various ignition and compression and carburetion components as the engine comes apart.	- Engine disassembly - Testing ignition, compression & carburetion	- Disassembly Quiz - Skills Grade - Employability grade	1.1.2.1 1.1.2.2 1.1.6.1 1.1.6.3 1.1.6.4

			3. How to use a manual for the various disassembly operations.			
Service & Repair	1. Micrometer Use 2. Pricing of engine repair	2 Week	1. How to use a micrometer and other measuring devices. 2. How to look up clearances in the manual. 3. How to determine flat rate scales and pricing of parts and labor.	- How to use micrometer - How to use engine manual - How to determine cost	- Service & Repair Quiz - Skills Grade - Employability grade	1.1.2.1 1.1.2.2 1.1.6.1 1.1.6.3 1.1.6.4 1.1.6.5 1.1.6.6
Assembly of the Engine	1. Engine assembly 2. Engine troubleshooting	2 Week	1. Assembly of the compression parts. 2. Assembly of the ignition parts. 3. Assembly of the carburetion parts. 4. Troubleshooting the engine.	- Assembly of all engine parts	- Assembly Quiz - Skills Grade - Employability grade	1.1.2.1 1.1.2.2 1.1.6.1 1.1.6.3 1.1.6.4 1.1.6.5 1.1.6.6
Trouble Shooting the Engine	1. Determine problem 2. Parts ordering	2 Week	1. Students will debug the school engine. 2. Students will order any parts needed for the engine. 3. Students will correct anything wrong with the engine. 4. Students will develop a bill of materials for the job to include labor, parts and tax	- Determining engine problem - Creating a bill of materials	- Trouble Shooting Quiz - Skills Grade - Employability grade	1.1.2.1 1.1.2.2 1.1.6.1 1.1.6.3 1.1.6.4 1.1.6.5 1.1.6.6
Engine Repair	1. Reassembling engine	2 Weeks	1. Clean and repair all engine parts.	- Reassembling engine	- Engine Repair Quiz	1.1.2.1 1.1.2.2

	2. Clean & Repair parts		2. Put the engine back together. 3. Get the engine running at the proper idle speed and high speed.	- Clean & repair parts (engine maintenance)	- Skills Grade - Employability grade	1.1.6.1 1.1.6.3 1.1.6.4 1.1.6.5 1.1.6.6
Final Report	1. Completion of assigned small gas engines project	3 Weeks	(Complete a pre-determined small gas engines project assigned my instructor) 1. Create a bill of materials, determine overall cost of project 2. Choose correct equipment and consumables	- Skills learned all semester will be used to complete final project	- Small gas engines project	1.1.2.1 1.1.2.2 1.1.6.1 1.1.6.3 1.1.6.4 1.1.6.5 1.1.6.6
Shop Cleaning	1. Cleaning shop in preparation for next year. 2. Equipment maintenance	1 Week	3. Clean all engines and tools and put them away properly	- Equipment maintenance	- Employability grade	1.1.2.1 1.1.2.2 1.1.4.1

PENNSYLVANIA AGRICULTURE EDUCATION CURRICULUM
CONTENT AREA: POWER AND SYSTEMS TECHNOLOGY STANDARDS

1. Standard: Students will understand. . .
1.1. Benchmark: Students will be able to. . .

1. Historical Applications and Future Implications of Agricultural Power and Systems Technologies
1.1. Describe and discuss the historical development of agricultural power and systems technologies
1.2. Identify global applications of agricultural power and systems technologies
1.3. Identify emerging technologies and their potential impact
1.4. Identify methods of changing appropriate technology for various applications (size, social and cultural)

2. Safety
2.1. Demonstrate positive safety attitudes and responsibilities
2.2. Recognize and demonstrate safety rules and regulations
2.3. Describe safety regulations and consumer safety protection opportunities

3. Careers in Agricultural Power and Systems Technology
3.1. Examine career opportunities in agricultural power and systems technologies
3.2. Identify advanced training and postsecondary education in agricultural engineering and systems technologies

4. Tools Equipment and Hardware
4.1. Identify, select, adjust, maintain and safely use common hand tools and power tools
4.2. Adjust, maintain and safely use common agricultural power shop equipment
4.3. Identify and select hardware used in the agricultural industry
4.4. Demonstrate accurate use of measurement devices and techniques for calculating measurement

5. Material Fabrication and Welding
5.1. Identify and select various types of metals and plastics, and welding and cutting equipment
5.2. Select, adjust and operate oxy-fuel and plastic welding equipment with and without appropriate filler rods
5.3. Select and safely operate appropriate electric and oxy-acetylene welding equipment
5.4. Demonstrate and identify the various types of quality welds and cuts, and their components to insure quality products

6. Engine Systems
6.1. Identify principles of small engine operation
6.2. Demonstrate the use of measuring devices for small engines
6.3. List the component parts of a small gas engine
6.4. Disassemble and reassemble a small engine using all diagnostic tools
6.5. Troubleshoot an engine and adjust to industry specifications

6.6. Maintain a small engine
6.7. Select engine coolants, lubricants, fuels, engine additives, electrical components and drive systems needed for various applications
6.8. Identify how the concern with engine emissions have affected the development of engine technologies
6.9. Identify new technology in diesel applications, such as common rail and computerized fuel systems
6.10. Identify biofuels and describe their effect on engine and fuel system maintenance

7. Machinery and Equipment Systems
7.1. Review service schedules and conduct procedures
7.2. Select, measure, use and calibrate testing devices for agricultural machines
7.3. Perform disassembly and assembly procedures
7.4. Select and safely connect, engage and operate machinery and power units
7.5. Demonstrate the correct selection and safe use of agricultural machinery and equipment systems
7.6. Demonstrate the use of auxiliary systems, including hydraulics, pneumatics and electronics
7.7. Conduct troubleshooting procedures

8. Energy Systems
8.1. Identify the parts and functions of the specific energy systems of mechanical power, solar power, wind power, electrical power and chemical power systems
8.2. Perform energy system maintenance, testing and evaluation
8.3. Discuss and explain the operating principles for energy systems
8.4. Explain and describe principles of power transmission, heat transfer, evaporation, fluid movement, conductivity, satellite transmission, conservation, sensing and regulation
8.5. Use computer applications in energy systems management
8.6. Identify and investigate emerging technologies and their economic impact on energy systems
8.7. Select appropriate industry standards for energy systems

9. Structural Systems
9.1. Conduct a site evaluation and determine elevation, slope and cut and fill requirements
9.2. Design, draw and interpret plans and drawings for structures with consideration to building codes, regulations and inspection requirements
9.3. Develop an itemized bill of materials; determine costs, delivery, storage requirements and construction time
9.4. Layout a structure foundation, erect batter boards, frames or forms
9.5. Identify and evaluate building construction materials, methods and styles
9.6. Calculate ventilation, insulation, heating, cooling, lighting, electrical, water and waste handling needs based on the enterprise considered (i.e., dairy, veal, hogs, plants, etc.)
9.7. Calculate, mix and finish concrete and masonry units
9.8. Design and construct wall and roofing systems
9.9. Demonstrate skills in the construction of an agricultural structure

10. Plumbing, Irrigation and Water Systems

10.1. Identify the various plastic and metal components and their functions within water supply, waste and vent systems
10.2. Cut, assemble and pressure test components within various types of water supply systems
10.3. Determine pump and pipe size, based on water requirements, head and friction losses for water and irrigation systems
10.4. Construct and identify the components in agricultural irrigation systems based on crop, greenhouse or landscaping needs
10.5. Identify the requirements of a safe water supply and necessary water treatment procedures

11. Environmental and Natural Resource Systems
11.1. Identify environmental problems and use equipment and tools needed to measure the problems in livestock, crop handling, processing, nursery and landscaping, aquaculture, forestry and agribusiness industries
11.2. Use various map types and aerial photos for land use, soil, watershed, wildlife, natural resource management and conservation
11.3. Use global positioning systems, remote sensing and collection equipment for agricultural applications
11.4. Read legal land descriptions and determine land areas using maps and onsite measuring techniques
11.5. Identify, construct and evaluate storage and waste disposal systems and procedures
11.6. Assemble environmental and natural resource system equipment and structures