



AGRICULTURAL MECHANICS POWER SYSTEMS

#01045

Description

Agricultural Mechanics courses are designed to reinforce and extend students' understanding of applied mechanical applications by associating scientific principles and concepts with relevant applications in fields associated with mechanics. Students will be exposed to fluid, electrical, and thermal power that are associated with the field of agriculture. Course is designed to provide students with applied activities which may include: small engine maintenance and repair, agricultural power and equipment, electric motors and controls, robotics, renewable energy and precision ag systems. Leadership development and supervised agricultural experiences are integral to these courses.

Grade 9-12

½ or 1 credit

Max Credit = 1

Standard 1	AGRICULTURE, FOOD, & NATURAL RESOURCES (AFNR) CLUSTER SKILLS	
Topic 1.5	<i>Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food, & Natural Resources career pathways.</i>	
Student Competencies		
	1.5.1	EVALUATE AND IMPLEMENT THE STEPS AND REQUIREMENTS TO PURSUE A CAREER OPPORTUNITY IN EACH OF THE AFNR CAREER PATHWAYS (E.G., GOALS, DEGREES, CERTIFICATIONS, RESUMES, COVER LETTER, PORTFOLIOS, INTERVIEWS, ETC.).
	1.5.1.1	Identify and summarize the steps to pursue a career in an AFNR pathway (e.g., self-assessment, set goals, etc.).
	1.5.1.2	Examine the educational, training, and experiential requirements to pursue a career in an AFNR pathway (e.g., degrees, certifications, training, internships, etc.).
	1.5.1.3	Research and summarize specific tools (e.g., resumes, portfolios, cover letters, etc.) and processes (e.g., interviews, applications, etc.) needed to pursue a career in an AFNR pathway.
	1.5.1.4	Create a personal plan outlining goals and steps to obtain a career in an AFNR pathway.
	1.5.1.5	Analyze personal skillset and create a plan for obtaining the required education, training, and experiences to obtain a career in an AFNR pathway.
	1.5.1.6	Assess personal goals, experiences, education, and skillsets and organize them to produce the appropriate tools and develop the skills to effectively communicate about one’s qualifications for an AFNR career.
	1.5.1.7	Evaluate progress toward AFNR career goals and identify opportunities for improvement and necessary adjustments to one’s plan of action.
	1.5.1.8	Implement one’s personal plan of action for obtaining the required education, training, and experiences and evaluate progress to identify opportunities for improvement and necessary adjustments.
	1.5.1.9	Evaluate, update, and improve a set of personal tools to reflect current skills, experiences, education, goals, etc. and complete the processes needed to pursue and obtain a career in an AFNR pathway.
	1.5.2	EXAMINE AND CHOOSE CAREER OPPORTUNITIES THAT ARE MATCHED TO PERSONAL SKILLS, TALENTS, AND CAREER GOALS IN AN AFNR PATHWAY OF INTEREST.
	1.5.2.1	Examine and categorize careers in each of the AFNR pathways.
	1.5.2.2	Research and describe careers in each of the AFNR pathways and choose potential careers connecting to personal interests and skills.
	1.5.2.3	Assess personal skills and align them with potential career opportunities in AFNR pathways.
	1.5.2.4	Assemble and analyze examples of careers and related statistics on a local, state, national, and global level.

	1.5.2.5	Interpret and evaluate the results of a personal career assessment and connect them to potential careers in AFNR pathways.
	1.5.2.6	Conduct interviews with career professionals within AFNR pathways and summarize the results.

Standard 7	NATURAL RESOURCE SYSTEMS
-----------------------	---------------------------------

Topic 7.3	<i>Develop plans to ensure sustainable production and processing of natural resources.</i>
------------------	--

Student Competencies	
-----------------------------	--

7.3.1	SUSTAINABLY PRODUCE, HARVEST, PROCESS, AND USE NATURAL RESOURCE PRODUCTS (E.G., FOREST PRODUCTS, WILDLIFE, MINERALS, FOSSIL FUELS, SHALE OIL, ALTERNATIVE ENERGY, RECREATION, AQUATIC SPECIES, ETC.).
-------	--

	7.3.1.5	Compare and contrast the costs and benefits (e.g., environmental impacts, etc.) of shale oil from fracking to a local, state, and/or national economy.
	7.3.1.6	Compare and contrast the costs and benefits (e.g., environmental impacts, etc.) of alternative sources of energy (e.g., hydroelectric, solar, wind, biofuels, geothermal, etc.).
	7.3.1.11	Assess the economic impact of mineral extraction in regards to the costs and benefits to a local, state, and/or national economy.
	7.3.1.12	Assess the economic impact of fossil fuel extraction in regards to the costs and benefits to a local, state, and/or national economy.
	7.3.1.13	Assess the economic impact of shale oil extraction (i.e., fracking) in regards to the costs and benefits to a local, state, and/or national economy.
	7.3.1.14	Assess and evaluate factors that affect the economic, environmental, and social sustainability in regards to the use of alternative sources of energy.
	7.3.1.19	Evaluate methods used to extract and process minerals for economic, environmental, and social sustainability.
	7.3.1.20	Evaluate methods used to extract and process fossil fuels for economic, environmental, and social sustainability.
	7.3.1.21	Evaluate methods used to extract and process shale oil for economic, environmental, and social sustainability.
	7.3.1.22	Assess trends in energy production and consumption in order to predict how the impact of alternative energy will change in the future.

Standard 9	POWER, STRUCTURAL, AND TECHNICAL SYSTEMS	
Topic 9.1	<i>Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural, and technical systems.</i>	
Student Competencies		
	9.1.1	APPLY PHYSICAL SCIENCE AND ENGINEERING PRINCIPLES TO ASSESS AND SELECT ENERGY SOURCES FOR AFNR POWER, STRUCTURAL, AND TECHNICAL SYSTEMS.
	9.1.1.1	Research and identify renewable and nonrenewable energy sources used in AFNR.
	9.1.1.2	Compare and contrast the pathways of delivery for renewable and nonrenewable energy sources in an AFNR enterprise or business.
	9.1.1.3	Summarize methods and compare and contrast units used to benchmark energy use of AFNR structures (e.g., EUIs, BTUs, etc.).
	9.1.1.4	Assess the environmental impacts of renewable and nonrenewable energy sources used in AFNR.
	9.1.1.5	Calculate the costs of using renewable and nonrenewable energy sources in an AFNR enterprise or business.
	9.1.1.6	Convert energy utilized in an AFNR structure to an energy utilization index (e.g., convert CCF, KWH, etc. to Btu consumption per square foot, etc.).
	9.1.1.7	Design and implement methods to evaluate the efficiency of renewable and nonrenewable energy sources used in AFNR.
	9.1.1.8	Devise a strategy to incorporate the use of selected energy sources in an ANFR enterprise or business.
	9.1.1.9	Apply energy benchmarking data to examine and select methods to conserve energy in AFNR structures.
	9.1.2	APPLY PHYSICAL SCIENCE AND ENGINEERING PRINCIPLES TO DESIGN, IMPLEMENT, AND IMPROVE SAFE AND EFFICIENT MECHANICAL SYSTEMS IN AFNR SITUATIONS.
	9.1.2.1	Compare and contrast applications of simple machines in AFNR related mechanical systems.
	9.1.2.2	Identify the tools, machines, and equipment needed to construct and/or fabricate a project in AFNR.
	9.1.2.3	Examine owner’s manuals to classify the types of safety hazards associated with different mechanical systems used in AFNR (e.g., caution, warning, danger, etc.).
	9.1.2.4	Perform mathematical calculations to determine the mechanical advantage of simple machines in AFNR related mechanical systems.
	9.1.2.5	Calculate the maintenance and purchase cost of tools, machines, and equipment used in AFNR.
	9.1.2.6	Select, maintain, and demonstrate the proper use of tools, machines, and equipment used in different AFNR related mechanical systems.
	9.1.2.7	Apply the scientific method to devise strategies to improve the efficiency of operation of AFNR related mechanical systems.

	9.1.2.8	Devise and document processes to safely implement and evaluate the safe use of AFNR related tools, machinery, and equipment.
	9.1.2.9	Conduct a safety inspection of tools, machines, and equipment used in different AFNR related mechanical systems.
Topic 9.2	<i>Operate and maintain AFNR mechanical equipment and power systems.</i>	
Student Competencies		
	9.2.1	PERFORM PREVENTATIVE MAINTENANCE AND SCHEDULED SERVICE TO MAINTAIN EQUIPMENT, MACHINERY, AND POWER UNITS USED IN AFNR SETTINGS.
	9.2.1.1	Maintain the cleanliness and appearance of equipment, machinery, and power units used in AFNR power, structural, and technical systems to assure proper functionality.
	9.2.1.2	Examine operator's manuals to determine recommendations for servicing filtration systems and maintaining fluid levels on equipment, machinery, and power units used in AFNR power, structural, and technical systems.
	9.2.1.3	Develop a preventative maintenance schedule for equipment, machinery, and power units used in AFNR power, structural, and technical systems.
	9.2.1.4	Service filtration systems and maintain fluid levels on equipment, machinery, and power units in accordance with operator's manuals.
	9.2.1.5	Devise a strategy to communicate to different audiences, preventative maintenance, and service schedule for equipment, machinery, and power units used in AFNR power, structural, and technical systems.
	9.2.1.6	Assess and adjust equipment (e.g., belts and drives, chains, sprockets, etc.) and maintain fluid conveyance components (e.g., hoses, lines, nozzles, etc.) to ensure proper functioning.
	9.2.2	OPERATE MACHINERY AND EQUIPMENT WHILE OBSERVING ALL SAFETY PRECAUTIONS IN AFNR SETTINGS.
	9.2.2.1	Research and summarize the use of equipment, machinery, and power units for AFNR power, structural, and technical systems.
	9.2.2.2	Examine and identify safety hazards associated with equipment, machinery, and power units used in AFNR power, structural, and technical systems (e.g., caution, warning, danger, etc.).
	9.2.2.3	Analyze and calculate the cost of using equipment, machinery, and power units for AFNR power, structural, and technical systems.
	9.2.2.4	Apply safety principles and applicable regulations to operate equipment, machinery, and power units used in AFNR power, structural, and technical systems.
	9.2.2.5	Perform pre-operation inspections, start-up, & shut-down procedures on equipment, machinery, and power units as specified in owner's manuals.
	9.2.2.6	Adjust equipment, machinery, and power units for safe and efficient operation in AFNR power, structural, and technical systems.

Topic 9.3	<i>Service and repair AFNR mechanical equipment and power systems.</i>	
	Student Competencies	
9.3.1	TROUBLESHOOT, SERVICE, AND REPAIR COMPONENTS OF INTERNAL COMBUSTION ENGINES USING MANUFACTURERS' GUIDELINES.	
	9.3.1.1	Identify and classify components of internal combustion engines used in AFNR power, structural, and technical systems.
	9.3.1.2	Distinguish the characteristics of spark-and-compression internal combustion engines used in AFNR power, structural, and technical systems.
	9.3.1.3	Analyze and explain how the components of internal combustion engines interrelate during operation.
	9.3.1.4	Utilize technical manuals and diagnostic tools to determine service and repair needs of spark-and-compression internal combustion engines used in AFNR power, structural, and technical systems.
	9.3.1.5	Evaluate service and repair needs for internal combustion engines using a variety of performance tests (e.g., manuals, computer-based diagnostics, etc.).
	9.3.1.6	Inspect, analyze and repair spark-and-compression internal combustion engines used in AFNR power, structural, and technical systems.
9.3.2	SERVICE ELECTRICAL SYSTEMS AND COMPONENTS OF MECHANICAL EQUIPMENT AND POWER SYSTEMS USING A VARIETY OF TROUBLESHOOTING AND/OR DIAGNOSTIC METHODS.	
	9.3.2.1	Compare and contrast basic units of electricity (e.g., volts, amps, watts, and ohms) and the principles that describe their relationship (e.g., Ohm's Law, Power Law, etc.).
	9.3.2.2	Compare and contrast the characteristics of electronic components used in AFNR power, structural, and technical systems (e.g., battery, resistor, diode, transistor, capacitor, etc.).
	9.3.2.3	Classify the uses of electrical sensors and controls in AFNR power, structural, and technical systems.
	9.3.2.4	Assess the tools used to measure the basic units of electrical circuits in AFNR power, structural, and technical systems, and perform the measurements.
	9.3.2.5	Analyze and interpret electrical system symbols and diagrams.
	9.3.2.6	Distinguish and select materials and tools used in electrical control circuit installation.
	9.3.2.7	Analyze and design electrical circuits for AFNR power, structural, and technical systems using knowledge of the basic units of electricity.
	9.3.2.8	Conduct testing procedures to evaluate and repair malfunctioning electrical components and systems used in AFNR power, structural, and technical systems.
	9.3.2.9	Plan and install electrical control circuits and/or circuit boards to assure proper operation within AFNR power, structural, and technical systems.

	9.3.3	UTILIZE MANUFACTURERS' GUIDELINES TO DIAGNOSE AND TROUBLESHOOT MALFUNCTIONS IN MACHINERY, EQUIPMENT, AND POWER SOURCE SYSTEMS (E.G., HYDRAULIC, PNEUMATIC, TRANSMISSION, STEERING, SUSPENSION, ETC.).
	9.3.3.1	Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural, and technical systems.
	9.3.3.2	Compare and contrast operation principles and features of mechanical transmission systems used in AFNR power, structural, and technical systems (e.g., belts, chains, gears, bearings, seals, universals, drive shafts, etc.).
	9.3.3.3	Identify and examine the components of suspension and steering systems used in AFNR power, structural, and technical systems.
	9.3.3.4	Analyze and interpret hydraulic and pneumatic system symbols and diagrams used in AFNR power, structural and technical systems.
	9.3.3.5	Utilize speed, torque, and power measurements to calculate efficiency in power transmission systems used in AFNR power, structural, and technical systems.
	9.3.3.6	Assess and analyze vehicle and machinery performance related to suspension and steering systems used in AFNR power, structural, and technical systems.
	9.3.3.7	Inspect, analyze, and repair hydraulic and pneumatic system components used in AFNR power, structural, and technical systems.
	9.3.3.8	Inspect, analyze, and repair the components of power transmission systems used in AFNR power, structural, and technical systems.
	9.3.3.9	Inspect, analyze, and repair vehicle suspension and steering systems used in AFNR power, structural, and technical systems.

Career Ready Practices (CRP)

FFA & SUPERVISED AGRICULTURAL EXPERIENCE

CRP 1	Act as a responsible and contributing citizen and employee.
CRP 2	Apply appropriate academic and technical skills.
CRP 3	Attend to personal health and financial well-being.
CRP 4	Communicate clearly, effectively, and with reason.
CRP 5	Consider the environmental, social, and economic impacts of decisions.
CRP 6	Demonstrate creativity and innovation.
CRP 7	Employ valid and reliable research strategies.
CRP 8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP 9	Model integrity, ethical leadership, and effective management.
CRP 10	Plan education and career path aligned to personal goals.
CRP 11	Use technology to enhance productivity.
CRP 12	Work productively in teams while using cultural/global competence.