TN Department of Education | College, Career and Technical Education

(Pending approval) for 2021-22 school year.

Principles of Agricultural Mechanics

Primary Career Cluster:	Agriculture, Food, & Natural Resources
Course Contact:	CTE.Standards@tn.gov
Course Code(s):	C18H12
Prerequisite(s):	*Agriscience* (C18H19)
Credit:	1
Grade Level:	10
Elective Focus - Graduation Requirements:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Agriculture, Food, & Natural Resources courses.
POS Concentrator:	This course satisfies one out of two required courses that must be taken from a single program of study to meet the Perkins V concentrator definition requirements.
Programs of Study and Sequence:	This is the second course in the *Agricultural Engineering, Industrial, and Mechanical Systems* program of study.
Aligned Student Organization(s):	FFA: http://www.tnffa.org
Coordinating Work-Based Learning:	All Agriculture students are encouraged to participate in a Supervised Agricultural Experience (SAE) program. In addition, Teachers are encouraged to use embedded WBL activities. For information, visit https://www.tn.gov/content/tn/education/career-and-technical-education/work-based-learning.html
Available Student Industry Certifications:	Students are encouraged to demonstrate mastery of knowledge and skills learned in this course by earning the appropriate, aligned department-promoted industry certifications. Access the promoted list here for more information.
Teacher Endorsement(s):	048, 150, 448, and 950
Required Teacher Certifications/Training:	No
Teacher Resources:	https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-agriculture-food-natural-resources.html

Course Description

Principles of Agricultural Mechanics is an intermediate course introducing students to basic skills and knowledge in construction and land management for both rural and urban environments. This course covers topics including project management, basic engine and motor mechanics, land surveying, irrigation and drainage, agricultural structures, and basic metalworking techniques. Upon completion of this course, proficient students will be prepared for more advanced coursework in agricultural engineering, industrial, and mechanical systems.

Approved April 10, 2015; Amended April 15, 2016

Program of Study Application

This is the second course in the *Agricultural Engineering, Industrial, and Mechanical Systems* program of study. For more information on the benefits and requirements of implementing this program in full, please visit the Agriculture, Food, & Natural Resources website at https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-agriculture-food-natural-resources.html.

Course Standards

Safety

1) Identify the benefits of knowing and applying basic safety procedures in both an agricultural laboratory and workplace. Interpret current Occupational Safety and Health Administration (OSHA) guidelines to conduct a compliance review of the agricultural laboratory, including a written summary justifying the findings with recommendations for improving the safety of working conditions.

2) Review common laboratory safety procedures for tool and equipment operation in the agricultural mechanics laboratories, including but not limited to accident prevention and control procedures. Demonstrate the ability to follow safety and operational procedures in a lab setting and complete a safety test with 100 percent accuracy.

Agricultural Math

3) Use measurement devices typically employed in agricultural design and fabrication to complete accurate measurements. Determine the appropriate units and accurate measures of lengths and angles. Tools should include but not be limited to: fractional rule, metric rule, measuring tape, architect's scale, engineer's scale, dial caliper, micrometer, protractor and square.

4) Apply mathematics concepts to solve agricultural mechanics problems, distinguishing which principles apply to a given construction, fabrication, or maintenance problem. Concepts should include, but are not limited to:
    a. Operating with whole numbers, fractions, and decimals.
    b. Performing conversions between fractions, decimals, and percent. For example, convert a decimal to a fraction to prepare a unit for measurement on a fractional scale to the precision of 1/16 of an inch.
    c. Working with units such as feet, inches, meters, centimeters, and millimeters, and determining appropriate units for a given agricultural mechanics task. For example, determine how many pieces of 2 ft. 4 in. can be cut from a 10 ft. piece of angle iron and how much angle iron will be left over.
    d. Calculating the area of two-dimensional spaces. Calculating surface area and volume for three-dimensional objects employing related geometric terminology.
    e. Performing proportionate reasoning to estimate quantities.
    f. Using basic rules of right triangles, such as the Pythagorean Theorem, to find missing lengths and areas.

5) Perform mathematical calculations to determine the mechanical advantage of simple machines in agricultural and related industry mechanical systems.

Project Management

6) Outline the basic principles and procedures of effective project planning. Create and present a project plan for an agricultural mechanics project or a supervised agricultural experience program related to agriculture mechanics.

7) Using industry-specific terminology, identify components for preparing a budget and cost estimate. Develop a budget using a scaled drawing or blueprint to construct or repair an agriculture mechanics project.

Engines, Motors, and Generators Systems

8) Compare and contrast the features, functions, and applications of two-cycle engines, four-cycle engines, and electric motors. Using technical references, recommend a maintenance schedule specific to the working environment (such as indoor/outdoor conditions, exposure to heat or cold) of the engine and/or motor. Conduct the appropriate maintenance with adherence to specifications outlined in the schedule.

9) Identify and differentiate between the different types of fuel and power sources using power engines and motors. Recommend the types and sizes of engines/motors best suited for a range of applications. Provide a written justification, citing specific textual evidence, to support the recommendation.

10) Compare and contrast the different classes of generators to recommend the proper generator to the application such as but not limited to agriculture production facilities, dairy farms, greenhouses, processing plants, mobile repair trucks, etc.

Surveying

11) Using topographical maps and appropriate mathematical equations, determine the acreage of a specific plot of land. Document and defend the methods used to arrive at the result, annotating calculations and field notes in a manner easily retrieved by other readers.

12) Apply precision surveying processes and geographic information system (GIS) technology to calculate the acreage of a specific plot of property. Using field notes and digital data (such as GIS overlays), develop a written survey report of the designated plot to include, at minimum, measurements, degrees, markers, and other notable geographic parameters.

Water and Waste Management

13) Analyze the interrelationships among plants, water, air, and soil to maximize the health and productivity of agricultural crops. Calculate the permeability rate, available water holding capacity, pH levels, and nutrient levels for a specific soil type.

14) Apply physics concepts governing various pumping systems and delivery options to achieve the optimum irrigation, watering, animal waste removal systems. Develop schedules and

water requirements to satisfy the design daily irrigation requirements (DDIR) for specific crops, watering systems, and the gallons required for a single animal waste flush.

15) Compare and contrast various irrigation methods for agriculture and horticulture crops, attending to such factors as water conservation, efficiency, and cost. Investigate and document findings on the effectiveness and efficiency of each irrigation method to recommend the most efficient system. Developing claim(s) and counterclaim(s) for scenarios in which each method would be most applicable.

Agricultural Structures

16) Interpret blue prints, construction plans, and working drawings to select appropriate building materials for a given agricultural structure. Using correct units and measurements, develop a written bill of materials enumerating the quantities of each selection, including but not limited to concrete, masonry, wood, metal, and composite materials.

17) Applying construction principles pertaining to wood, concrete, metal, masonry, plumbing and electricity construct or repair an agricultural structure according to prescribed blueprint or working plans.

Agricultural Welding and Fabrication

18) Compare and contrast the physical and chemical properties including procedures of welding and cutting process (e.g., shielded metal arc welding (SMAW), metal inert gas (MIG) welding, gas tungsten arc (TIG) welding, fuel-oxygen and plasma arc torch, etc.)

19) Analyze the situation and determine the best welding and cutting process to be used in metal fabrication or repair projects. Demonstrate the ability to operate according to safety procedures in applications involving various materials such as but not limited to: mild steel, copper, sheet metal, and aluminum.

20) Identify, sketch, and demonstrate the best method to construct or repair metallic and non-metallic materials for a variety of agricultural applications, including but not limited to plumbing, sheeting, facilities, and equipment.

Standards Alignment Notes

References to other standards include:

- SAE: Supervised Agricultural Experience: All Agriculture students are encouraged to participate in a Supervised Agricultural Experience program to practice and demonstrate the knowledge and skills learned in their agriculture courses.
- AFNR: National Agriculture, Food, & Natural Resources (AFNR) Career Cluster Content Standards. Students engaged in activities outlined above should be able to demonstrate fluency in Standards in CS, PST, ABS, NRS, ESS, and PS systems at the conclusion of the course.
- P21: Partnership for 21st Century Skills Framework for 21st Century Learning

- Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.