Department of Education | College, Career and Technical Education

May 2024

Principles of Agricultural Mechanics

Primary Career Cluster:	Agriculture, Food, & Natural Resources
Consultant:	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 to meet the Perkins V concentrator definition, when taken in sequence in the approved program of study.
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 who hold an active WBL certificate may offer placement for credit when the requirements of the state board's WBL Framework and the Department's WBL Policy Guide are met. For information, visit https://www.tn.gov/education/educators/career-and-technical-education/work-based-learning.html.
Promoted Tennessee Student Industry Credentials:	Credentials are aligned with postsecondary and employment opportunities and with the competencies and skills that students acquire through their selected program of study. For a listing of promoted student industry credentials, visit https://www.tn.gov/education/educators/career-and-technical-education/student-industry-certification.html.
Teacher Endorsement(s):	048, 150, 448, and 950
Required Teacher Certifications/Training:	None
Teacher Resources:	https://www.tn.gov/education/educators/career-and-technical-education/career-clusters/cte-cluster-agriculture-food-natural-resources.html Best for All Central: https://bestforall.tnedu.gov/

Course at a Glance

CTE courses provide students with an opportunity to develop specific academic, technical, and 21st century skills necessary to be successful in a career and in life. In pursuit of ensuring every student in Tennessee achieves this level of success, we begin with rigorous course standards which feed into intentionally designed programs of study.

Students engage in industry relevant content through general education integration and experiences such as career and technical student organizations (CTSO) and work-based learning (WBL). Through these experiences, students are immersed with industry standard content and technology, solve industry-based problems, meaningfully interact with industry professionals and use/produce industry specific, informational texts.

Using a Career and Technical Student Organization (CTSO) in Your Classroom

CTSOs are a great resource to put classroom learning into real-life experiences for your students through classroom, regional, state, and national competitions, and leadership opportunities. Below are CTSO connections for this course. This is not an exhaustive list.

- Participate in CTSO Fall Leadership Conference to engage with peers by demonstrating logical thought processes and developing industry specific skills that involve teamwork and project management.
- Participate in FFA career and leadership events (CDE/LDE) that align with this course including Agriscience Fair, Agricultural Issues, Agricultural Technology & Mechanical Systems, Agronomy, Employment Skills, Environmental & Natural Resources, Extemporaneous Speaking, Marketing Plan, Parliamentary Procedure, and Prepared Public Speaking.

Using Work-Based Learning (WBL) in Your Classroom

Sustained and coordinated activities that relate to the course content are the key to successful work-based learning. Possible activities for this course include the following. This is not an exhaustive list.

- **Standards 1.1-1.2** | During a visit to an industry site have the manager talk about safety in the workplace.
- **Standards 2.1-2.4** | Have a guest speaker explain the importance of project management or have students complete a project plan under the supervision and/or evaluated by a project manager.
- **Standards 3.1-3.2** | Have the students work with an engine or motor technician on a real project.
- **Standards 4.1-4.2** | Invite a local surveyor to work with students to survey a plot of land and provide a review of their field notes.
- **Standards 5.1-5.3** | Have students work on a project evaluated by an irrigation/drainage specialist.
- **Standards 6.1-6.2** | Contact a building inspector to talk with the class about building codes and the importance of following blueprints.
- **Standards 7.1-7.3** | Have the students work with an engineer on a real project.

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 mechanics.

Course Standards

1. Occupational Safety

1.1 Basic Safety: Identify the benefits of knowing and applying **basic safety procedures** in both an agricultural laboratory and the workplace. Interpret current Occupational Safety and Health Administration (OSHA) guidelines to conduct a compliance review of the agricultural laboratory.

1.2 Shop Safety: Review common laboratory **safety procedures for tool and equipment operation** in the agricultural mechanics laboratories, including but not limited to hand tools, power tools, 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.

2. Project Management

2.1 Planning: 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.

2.2 Designing: Demonstrate the ability to use a variety of **computer-aided design (CAD) software and programs** to create and design models and parts on a CNC machine or 3D printer.

2.3 Tools: Identify the appropriate tools needed to design and complete a project. Compare and contrast the **functions of hand and power tools** that may be selected for a project. Demonstrate the safe use and storage of **hand and/or power tools** associated with a project.

2.4 Budgets and Estimates: Using industry-specific terminology, identify **components for preparing a budget and cost estimate**. Develop an itemized budget using a spreadsheet accompanied by a scaled drawing or blueprint to construct or repair an agriculture mechanics project.

3. Engine and Motor Mechanics

3.1 Engine and Motor Characteristics: Compare and contrast the chief **features, functions, and applications of two-cycle engines, four-cycle engines, and electric motors**. Recommend a maintenance schedule specific to the working environment (e.g., 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.

3.2 Types of Power: Identify and differentiate between the different **types of fuel and power sources** used in conjunction with **engines and motors**. Recommend the types and sizes of engines/motors best suited for a range of applications.

4. Surveying

4.1 Calculating Land Area: 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.

4.2 Precision Digital Surveying: Apply precision **surveying processes and geographic information system (GIS) technology** to calculate the acreage of a specific property plot. Using field notes and digital data (e.g., GIS overlays), develop a written survey report of the designated plot to include, at minimum, measurements, degrees, markers, and other notable geographic parameters.

5. Irrigation and Drainage

5.1 Soil Characteristics on Plant Growth: 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.

5.2 Irrigation and Drainage Requirements: Apply physics concepts governing various pumping systems and delivery **options to achieve the optimum irrigation and drainage requirements** for row crop, greenhouse, and nursery operations. Develop irrigation schedules to satisfy the design of daily irrigation requirements (DDIR) for specific crops.

5.3 Irrigation Methods: Compare and contrast **irrigation methods for row crops**, attending to such factors as water conservation, efficiency, and cost. Investigate and document findings on the effectiveness and efficiency of a surface irrigation versus a drip irrigation method, developing claim(s) and counterclaim(s) for scenarios in which each method would be most applicable.

6. Agricultural Structures

6.1 Building Materials: Read and interpret blueprints or building plans to **select appropriate building materials for a given agricultural structure**. Using correct units and measurements, draft a written bill of materials enumerating the quantities of each selection, including but not limited to concrete, masonry, wood, metal, and composite materials.

6.2 Construction: Apply **construction principles** pertaining to wood, concrete, metal, masonry, plumbing, and electricity. Construct or repair agricultural structures according to prescribed working plans.

7. Agricultural Metalworking

7.1 Welding Methods: Compare and contrast the physical and chemical properties between **shielded metal arc welding (SMAW), metal inert gas (MIG) welding, gas welding, soldering, and brazing**. Safely set up equipment, identify the components, and explain the electrical or gas welding process for each welding method. Demonstrate the ability to precisely follow operational and safety procedures for each fusion process across various applications.

7.2 Cutting Methods: Classify the physical and chemical **properties associated with various metal-cutting methods**. Safely set up equipment, identify the components, and explain the cutting process for each cutting method. Demonstrate adherence to operational and safety procedures for using oxy-fuel or plasma.

7.3 Metallic and Non-Metallic Materials: Select and demonstrate the best method to **construct, connect, or repair metallic and non-metallic materials** for a variety of agricultural applications, including but not limited to plumbing, sheeting, and equipment.

Standards Alignment Notes

References to other standards include:

- SAE for All: Evolving the Essentials: All Agriculture students are encouraged to participate in a Supervised Agricultural Experience (SAE) 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 the 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.