Department of Education | College, Career and Technical Education (Pending Approval) Published for 2021-22 school year.

Agricultural Power and Equipment

Primary Career Cluster:	Agriculture, Food, & Natural Resources
Course Contact:	CTE.Standards@tn.gov
Course Code(s):	C18H13
Prerequisite(s):	*Principles of Agricultural Mechanics* (C18H12)
Credit:	1
Grade Level:	11
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 third 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:	None
Teacher Resources:	https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-agriculture-food-natural-resources.html

Course Description

Agricultural Power and Equipment is an applied course in the agricultural engineering, industrial, and mechanical systems program of study with special emphasis on laboratory activities involving small

engines, generators, tractors, and agricultural equipment. The standards in this course address navigation, maintenance, repair, and overhaul of electrical motors, hydraulic systems, and fuel-powered engines as well as exploration of a wide range of careers in agricultural mechanics. Upon completion of this course, proficient students will be able to pursue advanced training in agricultural engineering, industral, mechanical, and related fields at a postsecondary institution.

Program of Study Application

This is the third 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 and Natural Resources website at https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-agriculture-food-natural-resources.html.

Course Standards

Occupational Awareness & Safety

1) Consult industry manuals to ascertain the specific safety prevention and control standards governing the agricultural industry such as but not limited to the National Safe Tractor and Machinery Operation Program (NSTMOP), Occupational Safety and Health Administration (OSHA), etc.. Demonstrate adherence to recognized safety occupational standards across all coursework, such as but not limited to procedures surrounding general safety, personal safety (such as the use of personal protective equipment), lifting, transporting, alerting, and reporting.

2) Review common laboratory safety procedures for tool and equipment operation in the agricultural power and equipment 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.

3) Explore and compare local, regional, state, national, and global career opportunities in the agricultural power and equipment industry. Use multiple print, online, and/or personal interview sources, to capture at minimum the following:
    a) Job description
    b) Essential knowledge and skills
    c) Program or path of study to reach occupational goals, starting with high school through postsecondary and/or military options
    d) Credentialing and/or licensure requirements
    e) Non-educational job requirements such as minimum age, experience in the field, physical fitness tests, background checks or other notable evaluations
    f) Resume writing

4) Investigate opportunities to expand and diversify a Supervised Agricultural Experience (SAE) program as related to agriculture power and equipment. Accurately maintain an activity

recordkeeping system and apply proper financial recordkeeping skills to summarize records by completing SAE related applications and reports.

Engine, Motor, and Generator Systems

5) Compare and contrast the first and second laws of thermodynamics as applied to the study of combustion engines. Analyze the operation and efficiency of internal combustion engines with regard to fuels, engine displacement, ignition, lubrication, and cooling.

6) Evaluate and use diagnostic tools to optimize engine, motor, and generator performance under load and no-load operation, considering the effects of air temperature, humidity, fuel quality, and engine tuning.

7) Demonstrate the ability to service, troubleshoot, and repair small gasoline engines, electric motors and generators using a variety of performance test including but not limited to manuals, computer-based diagnostics, etc. Create a written estimate of repairs, including parts, labor, time, and total cost.

8) Develop a written recommendation outlining a specific task or procedure for a given engine or motor (such as using a single-phase 5 hp electric motor in order to drive a 125-foot conveyor belt for lifting grain to a 60-foot silo.)

Agriculture Machinery

9) Recommend the appropriate machinery for a given agricultural application by matching the mechanical need to the scale and magnitude of the specific task. Compare and contrast the recommendations based on availability of parts, operational costs, maintenance, safety, and acquisition cost. (e.g., recommend the appropriate tractor for a specified task based on power ratings, engine and transmission systems, hydraulic capabilities, hitching, ballasting, retail price, and finance charges.)

10) Explain the basic types of fuel and lubricants, differentiate their chief components, characteristics and applications as related to agricultural equipment.

11) Develop a preventative maintenance schedule for equipment, machinery and power units used in the agriculture industry. Devise a strategy to communicate to different audiences, preventative maintenance and service schedules for equipment and power units. Demonstrate the ability to adjust, maintain, troubleshoot, and repair agricultural equipment create a written estimate of repairs including itemization of parts, labor, time, and total cost.

12) Compare and contrast the types and functions of precision, technical control and advanced technologies (such as geographic information systems [GIS], global positioning systems [GPS], and unmanned aircraft systems [UAS]) available to the agriculture industry including.

13) Demonstrate in a live setting or in a presentation the ability to safely operate agriculture equipment, including precision-operated equipment using different operating and diagnostics platforms.

Hydraulic and Pneumatic Systems

14) Explain the components and operational theory of a basic hydraulic system used in an agriculture setting.

15) Design a hydraulic system to perform a specific task, applying the principles of fluid kinematics and hydrostatics to outline how the system functions. The design should include specifications for pumps, pipes, and flow rates.

16) Inspect, analyze, troubleshoot, and repair hydraulic and pneumatic power and control system components used in agricultural equipment such as piston-driven lifts and compression devices (such as shears, crushers.) Document the parts and labor involved to draft a repair bill for suitable compensation.

Precision Navigation and Surveying Systems

17) Explain how geographic information systems (GIS), global positioning systems (GPS), and unmanned aircraft systems (UAS) are linked together to solve problems and perform precision agricultural task using required platforms such as GIS software, GPS receivers, data acquisition, and spatial analysis of data. Critic the legal, ethical, and economic implications of the use of these emerging platforms and technologies with regard to maximizing the efficiency and efficacy of agricultural processes.

18) Install, maintain, and service instrumentation and equipment used for precision technology (e.g. GPS receivers, remote sensors, drone motors, etc.) used within the agriculture industry.

19) Find common data sources that can be used to conduct geospatial analysis. Compare and contrast government versus open-source databases for retrieving a range of geospatial data. For example, compare the validity of data retrieved from OpenStreetMap (OSM) with data retrieved from the Census Bureau.

20) Collect data and create maps utilizing geospatial technology platforms. Correctly and safely use precision surveying instruments to make measurements of large acreages. Compile a written survey report for use by a lay reader, supplementing the narrative with charts, graphs, and other visual representations to aid comprehension.

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, PS, and ESS 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.