Department of Education | College, Career and Technical Education

Agricultural and Biosystems Engineering

Primary Career Cluster:	Agriculture, Food, & Natural Resources
Consultant:	Steven Gass, (615) 532-2847, Steven.Gass@tn.gov
Course Code(s):	5963
Prerequisite(s):	*Agricultural Power and Equipment* (5945)
Credit:	1
Grade Level:	12
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.
Programs of Study and Sequence:	This is the fourth and final course in the *Agricultural Engineering and Applied Technologies* program of study.
Aligned Student Organization(s):	FFA: http://www.tnffa.org Joshua Bledsoe, Executive FFA Secretary, (615) 477-1857 Stena Meadows, East Tennessee FFA Consultant, (423) 414-8669 Vacant, Middle Tennessee FFA Consultant Vacant, West Tennessee FFA Consultant
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:	Briggs & Stratton Master Service Technician
Dual Credit or Dual Enrollment Opportunities:	There are dual credit opportunities with Tennessee State University.
Teacher Endorsement(s):	048, 150, 448
Required Teacher Certifications/Training:	None
Teacher Resources:	https://tn.gov/education/article/cte-cluster-agriculture-food-natural-resources.

Course Description

Agricultural and Biosystems Engineering is an applied course that prepares students for further study or careers in engineering, environmental science, agricultural design and research, and agricultural mechanics. Special emphasis is given to the many modern applications of geographic information systems (GIS) and global positioning systems (GPS) to achieve various agricultural goals. Upon completion of this course, proficient students will be able to pursue advanced training in agricultural engineering and related fields at a postsecondary institution.

Approved April 10, 2015; Amended April 15, 2016

Program of Study Application

This is the fourth and final course for the Agricultural Engineering and Applied Technologies 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 and biosystems engineering 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.

Occupational Research and Awareness

3) Gather and analyze information from multiple authoritative sources such as the United States Bureau of Labor Statistics to develop a written projection of the occupational trends related to agricultural engineering. Supplement the narrative with relevant and properly cited charts, graphs, and other visual representations.

Project Planning and Management

4) Design a project plan for an agricultural engineering project, outlining a strategy for working within a given set of parameters, constraints, and resources. Include in the plan components related to the budget, timeline, safety considerations, and strategies to minimize adverse environmental impacts.

Geographic Information Systems, Precision Measurements, and Management

5) Synthesize case studies and field experience to provide evidence of the impact of geographic information systems (GIS) and global positioning systems (GPS) on agricultural demographics, precision agriculture, pasture management, water quality, watershed management, and waste pollution. Discuss the implications for industry and labor with the incorporation of these technologies into more and more facets of agricultural life.

6) Identify various GIS and GPS applications and explain their uses in precision agriculture, including but not limited to the following: precision agriculture management zones, crop water and drought areas, crop imaging, land correlation to crop yields, yield map cleaning and management, drainage analysis and tile mapping, crop data analysis, soil darkness mapping, suitability modeling, and slope angle and accuracy.

7) Demonstrate the ability to make land use, management, development, and equipment recommendations for a specific plot of land in rural and urban settings. Provide graphical and textual evidence to support each recommendation.

Geographic Information Systems, Irrigation, and Drainage

8) Analyze, map, and disseminate geographic information systems (GIS) and global positioning systems (GPS) data portraying a drainage map of a specified region. Citing specific evidence from findings, propose changes to drainage and irrigation systems and justify recommendations against accepted soil erosion control practices.

9) Describe the relationships between concepts of hydrostatics, kinematics, and dynamics of fluid flows used for agricultural industry irrigation systems, including but not limited to pipes and open channels, using domain-specific language.

Structures: Environmental Impacts, Efficiency, and Certifications

10) Research agricultural buildings and facilities that meet industry benchmarks for energy efficiency and environmental sustainability. Collect observations on the costs and benefits of such structures and make recommendations to conserve energy and decrease operational cost, developing claim(s) with specific evidence from research.

11) Create a detailed construction plan for an agricultural facility suitable for a designated site, using natural systems and renewable energy where possible, and conserving energy and material resources in construction and maintenance while meeting building certification requirements. Include plans for recreating land or environments impacted by the construction (i.e., replacing displaced wetland with an artificial wetland).

Biophysical Properties of Crops and Food Products

12) Analyze the physical properties of selected agricultural crops and food products as they impact harvesting, storage, processing, and transport requirements, including but not limited to density, shape, moisture content, water potential, friction and flow of particulate solids, terminal velocity, thermal properties, and viscoelastic behavior of solids. Develop a fact sheet detailing the appropriate harvesting, storage, processing, and transportation equipment required for the range of crops and products analyzed, providing written justification for the use of chosen equipment.

Biochemistry of Agricultural Fertilizers and Chemicals

13) Develop a safety, storage, and disposal plan for agricultural chemicals such as pesticides, fertilizers, and veterinary medicines. Outline specific procedures pertaining to responsible selection and storage, mixing, transport, application, and disposal of waste, in compliance with applicable regulatory standards.
14) Analyze the chemical and physical properties of selected agricultural fertilizers and chemicals in relation to specific crops and determine the most efficient and effective method of application. Demonstrate in a live setting or presentation the ability to calibrate equipment for liquid, solid, and gaseous applications.

Capstone Project

15) Participate in a team-driven agricultural engineering project approved by the instructor that includes research, planning, analysis, construction, testing, and evaluation phases to measure success and adherence to legal constraints. Prepare periodic oral and written reports to demonstrate progress.

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 ABS, CS, and FPP 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.