Department of Education | College, Career and Technical Education

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Agriscience

Primary Career Cluster:	Agriculture, Food, & Natural Resources
Course Contact:	CTE.Standards@tn.gov
Course Code(s):	C18H19
Prerequisite(s):	*None*
Credit:	1
Grade Level:	9
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. In addition, this course satisfies the third lab science credit requirement for graduation.
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 first course in the *Agribusiness, Agricultural Engineering, Industrial, and Mechanical Systems, Environmental and Natural Resources Management, Food Science, Horticulture Science,* and *Veterinary and Animal Science* programs 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/content/tn/education/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/career-and-technical-education/student-industry-certification.html
Teacher Endorsement(s):	(048 and 015), (048 and 016), (048 and 017), (048 and 081), (048 and 126), (048 and 127), (048 and 128), (048 and 129), (048 and 151), (048 and 211), (048 and 212), (048 and 213), (048 and 214), (048 and 414), (048 and 415), (048 and 416), (048 and 417), (048 and 418), (048 and 449), (048 and 951) (150 and 015), (150 and 016), (150 and 017), (150 and 081), (150 and 126), (150 and 127), (150 and 128), (150 and 129), (150 and 151), (150 and 211), (150 and 212), (150 and 213), (150 and 214), (150 and 414), (150 and 415), (150 and 416), (150 and 417), (150 and 418), (150 and 449), (150 and 951), (448 and 015), (448 and 016), (448 and 017), (448 and 081), (448 and 126), (448 and 127), (448 and 128), (448 and 129), (448 and 151), (448 and 211), (448 and 212), (448 and 213), (448 and 214), (448 and 414), (448 and 415), (448 and 416), (448 and 417), (448 and 418), (448 and 449), (448 and 951), (950 and 015), (950 and 016), (950 and 017), (950 and 081), (950 and 126), (950 and 127), (950 and 128), (950 and 129), (950 and 151), (950 and 211), (950 and 212), (950 and 213), (950 and 214), (950 and 414), (950 and 415), (950 and 416), (950 and 417), (950 and 418), (950 and 449), (950 and 951)
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 Best for All Central: https://bestforall.tnedu.gov/

Approved April 10, 2015; Amended April 15, 2016; Amended Nov. 6, 2020; Amended Oct. 29, 2021

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 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 & 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 & Mechanicals Systems, Agronomy, Conduct of Meetings, Creed Speaking, Employment Skills, Environmental & Natural Resources, and TN FFA Quiz Bowl.

For more ideas and information, visit Tennessee FFA at https://tnffa.org/

Using a 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 agriculture production facility or agribusiness facility. have the manager talk about safety in the workplace.
- **Standards 2.1-2.3 |** Invite a guest speaker to talk about the impact agriculture has on society at the local, regional, state, national, and global levels.
- **Standards 3.1-3.3 |** Have the students do a project that is supervised or evaluated by an environmental scientist or wildlife biologist.
- **Standards 4.1-6.2** | Contact an animal geneticist to talk with the class about the positive uses of genetics and genomics have on animal health and producing safe and high quality food.
- **Standards 7.1-7.2 and 9.1-9.3**| Have a local veterinarian speak to the class about the importance of knowing the function of an animal's body systems to properly care for animals.
- **Standards 8.1-8.2** | Contact an agricultural extension agent to work with students to interpret basic soil analysis.
- **Standards 10.1-10.3** | Have the students do a project that is supervised or evaluated by a local electrician.

- **Standards 11.1-11.2**| Invite a small engine technician to the classroom to explain the chemical reactions that convert fuel energy into kinetic and heat energy in gas and diesel engines.

Course Description

Agriscience is an introductory laboratory science course that prepares students for biology, subsequent science and agriculture courses, and postsecondary study. This course helps students understand the important role that agricultural science and technology plays in the twenty-first century. In addition, it serves as the first course for all programs of study in the Agriculture, Food, & Natural Resources cluster. Upon completion of this course, proficient students will be prepared for success in more advanced agriculture and science coursework. This course counts as a lab science credit toward graduation requirements.

Course Standards

1. Agriscience Safety and Careers

1.1 Safety: Identify and explain **general laboratory safety procedures** including, but not limited to, prevention and control procedures in agriscience laboratories. Demonstrate safety procedures and complete safety test with 100 percent accuracy.

1.2 Careers: Explore and compare **local, regional, state, national, and global career opportunities** in the agriscience 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

2. Agriscience Investigation and Overview

2.1 Overview: Articulate important **historical and current events** impacting the **agricultural industry and agricultural youth development**. Include landmark laws, theories, and practices such as, but not limited to, the Morrill Act, the Smith-Lever Act, the Smith-Hughes Act, and influential figures such as John Deere, Henry Groseclose, Booker T. Washington, and important government agencies in the promotion of knowledge and technology of agricultural science, biotechnology, and key technological developments.

2.2 Economic Impact: Analyze information to summarize the **agricultural industry's economic impact**. Explain the **major agriculture commodity** trends and its importance to Tennessee, the United States, and the global economy. Develop a **foundational Supervised Agricultural Experience program** that provides growth into an immersion SAE with an opportunity to implement multiple science and engineering practices:

a. AQDP – asking questions and developing problems
b. MOD – developing and using models

c. PCI – planning and carrying out investigations
d. AID – analyzing and interpreting data
e. UMCT - using mathematics and computational thinking
f. CEDS – constructing explanations (for science) and designing solutions (for engineering)
g. EAE – engaging in argument from evidence
h. OECI – obtaining, evaluating, and communicating information

2.3 Solutions: Define the criteria for successful **solutions** to common agricultural problems and identify **relevant constraints** (including social and political constraints). Include problems at the local, state, national, and global level. Evaluate solutions to these problems and how the solutions meet the defined **criteria** and **constraints**. For example, how to grow larger quantities of safe high-quality food on less land to feed the growing population.

3. Fundamentals of Environmental Systems

3.1 Systems: Research a variety of **controlled environment systems** including, but not limited to , aquaponic systems, from recycled bottles, hydroponic setups, wildlife habitats, greenhouses, etc. Design a controlled environment that accounts **for the inputs, outputs, and stability of flows of matter** from the major biogeochemical cycles – such as carbon, nitrogen, phosphorus, and water.

3.2 Models: Develop **models for the flow of energy and matte**r (inorganic forms and overall biomass) in various ecosystems impacting agricultural and environmental systems. Using these models, calculate rates of productivity by analyzing the major components of a food chain. Employ **mathematical models** to explain growth patterns and rates, both density-dependent and density-independent **factors, observed in ecosystems energy and nutrients flow.**

3.3 Biodiversity: Evaluate the impact of **habitat fragmentation, destruction, and other environmental pressures,** such as invasive species, overharvesting, pollution, and climate change on local and global biodiversity (genetic, species, and ecosystems.) Distinguish between **types of pollution (point and not-point sources)** and their sources to predict the **effects on environmental conditions** (e.g., water, soil, and air), animal populations, and plant populations from various kinds of human activity.

4. Fundamentals of Cell Structures and Processes

4.1 Cell Structures: Explain the major events of the **eukaryotic cell cycle** which accounts for a single cell growing into a multicellular plant or animal that may have its own reproductive capacity. Compare and contrast **cell division in various eukaryotic cell types** in plants and animals.

4.2 Processes: Gather evidence to support that the arrangement of cells into **tissues, organs, and systems** meets the needs of an entire organism. For example distribution of water and nutrients to all cells in plants and animals.

5. Fundamentals of Genetics, Genomics, and Heredity

5.1 Role of Genetics and Genomics: Evaluate the **roles of genetics and genomics** in understanding health and disease. Describe the **impact genomics has made in the plant and animal science industry**. Compare and contrast the important connections between these advancements, including, but not limited, to the clustered regularly interspaced short palindromic repeater (CRISPR) technology and agricultural consumer's views about the way these technologies impact food products.

5.2 Genetic Data: Analyze and interpret data (e.g., pedigrees, genetic markers, birth weights) that supports how **sexual and asexual reproduction** in plants and animals contributes or limits to genetic variation in populations.

6. Fundamentals of Anatomy and Physiology

6.1 Animal Systems: Identify and describe the major **animal body systems (skeletal, muscular, respiratory, digestive, nervous, circulatory, and reproductive)**. Develop explanations for the **relationships between the structure of individual parts and their function in the larger system** for common livestock, companion animal, and wildlife species. (E.g., Tendons transfer muscle movements to the skeletal system by attaching bones and muscles together.)

6.2 Form and Function: Apply the **selection of specific traits** to common animal breeds with different **intended or domesticated uses**, such as but not limited to draft horse versus light horse, meat cattle versus dairy cattle. Explain the **form of domestic and wild animals** to their intended uses or to their adaptive environmental niche.

7. Fundamentals of the BioChemistry of Animal Digestion

7.1 Digestion: Explain the sequential organization of the different **types of digestive systems** in domestic animals and compare and contrast **anatomical and physiological differences** between monogastric and ruminants and herbivores versus carnivores. Analyze the **stages of digestion and associated processes**, including enzymes and hormones, for a simple and multi-chambered stomach.

7.2 Nutritional Deficiencies: Develop a solution to eliminate dietary **deficiencies** identified through the **analysis of feedstuffs**. Solutions should adhere to specified criteria for proper nutrition based on animal purpose, age, lifespan, and relevant constraints such as environmental factors and expense.

8. Fundamentals of Plant and Soil Science

8.1 Fundamentals of Plant Growth: Apply concepts related to the basic **cellular and biochemical process** in plants to demonstrate the following:

a. Create a graphic illustration of the parts and functions of plant cells.
b. Use quantitative reasoning to balance chemical equations related to plant processes.
c. Interpret the role of physics within the cohesion/tension theory and its significance to plant life.
d. Examine the roles of photopigments and the effects of different colors of light on plant growth.

8.2 Fundamentals of Soil Science: Analyze models to explain the correlation between **plant nutrient deficiencies and soil composition**. Conduct basic soil analysis to determine the **chemical elements and nutritional levels available in various soils** that are essential for plant growth. Predict the ability of soils to meet the nutritional requirements of plants based on chemical composition, physical structure, and biological activity.

9. Fundamentals of Plant and Animal Reproductive Systems

9.1 Fundamentals of Plant Reproductive Systems: Compare and contrast the basic **reproductive structures of plants**, drawing out key differences between **sexual and asexual reproduction** processes used in plant reproduction.

9.2 Seed Anatomy: Using various seed models, analyze the **structure and function** of each to predict their roles in **plant reproduction and propagation**.

9.3 Fundamentals of Animal Reproduction Systems: Identify and describe the organs of the **male and female animal reproductive systems** that provide **physiological functions**. Compare and contrast the **differences** of the reproductive systems **between small and large animal species**.

10. Fundamentals of Power and Energy Systems

10.1 Energy: Use models to evaluate the **changes in energy** in agricultural applications.

a. Define types of energies and objects present in a system.
b. Analyze the relations between changes in energy and work done on/by the system.
c. Use evidence to support that simple machines use a tradeoff in force for distance to accomplish the same amount of work, while obeying the law of conservation of energy.
d. Evaluate inefficiencies in designed systems that result from energy transfers to the surroundings.
e. Explain energy transfers through radiation and how energy transferred from the sun can be stored and transferred for later use.

10.2 Safety: Identify different models of producing **electrical energy**. Discuss the **safety hazards** as well as prevention and control methods relevant to electrical power models. Predict **strategies to prevent or manage electrical hazards** and evaluate the efficacy of the prevention measures.

10.3 Energy Consumption: Summarize methods and compare units used to benchmark **energy use**. Utilize the **appropriate instruments needed** to calculate and measure voltage, amperage, resistance, and wattage.

11. Fundamentals of Engines

11.1 Engine cycles: Develop models that explain how **changes in chemical energy, thermal energy and states of matter** allow the operation of small gasoline and diesel engine cycles.

11.2 Horsepower: Using mathematical models, calculate **horsepower and thermal efficiency** for a variety of internal combustion engines.

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 who are engaging in activities outlined above should be able to demonstrate fluency in Standards AS, CS, and PS 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.