2026 Diversified Agriculture—Mechanization Core

Program CIP: 01.0000— Agriculture, General

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Office of Career and Technical Education
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The Research and Curriculum Unit (RCU), located in Starkville, as part of Mississippi State University (MSU), was established to foster educational enhancements and innovations. In keeping with the land-grant mission of MSU, the RCU is dedicated to improving the quality of life for Mississippians. The RCU enhances the intellectual and professional development of Mississippi students and educators while applying knowledge and educational research to the lives of the people of the state. The RCU works within the context of curriculum development and revision, research, assessment, professional development, and industrial training.

Table of Contents

Acknowledgments 3
Standards 4
Preface 5
Mississippi Teacher Professional Resources 6
Executive Summary 7
Course Outlines 8
Career Pathway Outlook 9
Professional Organizations 13
Using This Document 14
Unit 1: Leadership and SAE for All 15
Unit 2: Safety in Agricultural Mechanics 17
Unit 3: Introduction to Agricultural Mechanization 19
Unit 4: Oxyfuel and Plasma-Cutting Operations 20
Unit 5: Principles of Welding 22
Unit 6: Hydraulic and Pneumatic Systems in Agriculture 24
Unit 7: Electrical Systems Applications in Agriculture 25
Unit 8: Principles of Engines 26
Unit 9: Service, Management, and Operation of Agricultural Equipment 28
Student Competency Profile 30
Appendix A: Industry Standards 32
Appendix B: Academic Standards 45
Appendix C: CTSO Standards 48

Acknowledgments

The Diversified Agriculture—Mechanization Core curriculum was presented to the Mississippi State Board of Education on January 15, 2026. The following people were serving on the state board at the time:

Dr. Lance Evans, State Superintendent of Education, Executive Secretary
Mr. Matt Miller, Southern Supreme Court District Representative, Chair
Mr. Matt Mayo, Central Supreme Court District Representative, Vice-Chair
Dr. Wendi Barrett, Teacher Representative
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The following Mississippi Department of Education (MDE) Office of Career and Technical Education (CTE) and Workforce Development (WD) and RCU managers and specialists assisted in the development of the Diversified Agriculture— Mechanization Core curriculum:

Brett Robinson, Associate State Superintendent, MDE Office of CTE and WD
Betsey Smith, Director, RCU
Abbigail Dugas, Agriculture Program Supervisor, MDE Office of CTE and WD
Courtney McCubbins, CTE Curriculum and Assessment Manager, RCU
Tyler Gray, Project Manager, RCU

Special thanks are extended to the educators who contributed to the development and revision of this framework and supporting materials:

Ken Chatham, Forrest County Agricultural High School, Brooklyn
Rodney Fagan, Alcorn Career and Technology Center, Corinth
Thomas Hall, Northeast Jones High School, Laurel
Matt Powell, Pontotoc Ridge Career and Technology Center, Pontotoc

Appreciation is expressed to the following professionals who provided guidance and insight throughout the development process:

Dr. OP McCubbins, Associate Professor of Agricultural Education at MSU

Standards

Standards and alignment crosswalks are referenced in the appendices. Depending on the curriculum, these crosswalks should identify alignment to the standards mentioned below, as well as possible related academic topics as required in the Subject Area Testing Program in Algebra I, Biology I, and English II, which could be integrated into the content of the units. Mississippi's CTE Diversified Agriculture—Mechanization Core curriculum is aligned to the following standards:

National Agriculture, Food, and Natural Resources (AFNR) Career Cluster Content Standards
The National AFNR Career Cluster Content Standards were developed by the National Council on Agricultural Education to serve as a guide for what students should know or be able to do through a study of agriculture in grades 9-12 and two-year postsecondary programs. The standards were extensively researched and reviewed by leaders in the agricultural industry, secondary and postsecondary instructors, and university specialists. The standards consist of a pathway content standard for each of the eight career pathways. For each content standard, performance elements representing major topic areas with accompanying performance indicators were developed. Measurements of assessment of the performance elements and performance indicators were developed at the basic, intermediate, and advanced levels. The National AFNR Career Cluster Content Standards are copyrighted by the National Council for Agricultural Education and are used with permission.
thecouncil.ffa.org/afnr

College- and Career-Readiness Standards
College- and career-readiness standards emphasize critical thinking, teamwork, and problem-solving skills. Students will learn the skills and abilities demanded by the workforce of today and the future. Mississippi adopted Mississippi College- and Career-Readiness Standards (MCCRS) to provide a consistent, clear understanding of what students are expected to learn.
mdek12.org/academiceducation/mississipp-college-and-career-readiness-standards/

Career and Technical Student Organizations (CTSOs)
Mississippi's Career and Technical Education (CTE) curricula are aligned with the programs, activities, and competitive events offered through Career and Technical Student Organizations (CTSOs). These organizations provide students with opportunities to apply classroom knowledge in real-world contexts, develop leadership and employability skills, and connect with industry and community partners. Each pathway includes an appendix identifying the CTSOs most closely connected to the curriculum, ensuring that students' classroom learning is reinforced through co-curricular experiences that prepare them for success in both post-secondary education and the workforce.
mdek12.org/cte/so/

Preface

Secondary CTE programs in Mississippi face many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing applied learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments. This document provides information, tools, and solutions that will aid students, teachers, and schools in creating and implementing applied, interactive, and innovative lessons. Through best practices, alignment with national standards and certifications, community partnerships, and a hands-on, student-centered concept, educators will be able to truly engage students in meaningful and collaborative learning opportunities.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, *Mississippi Code of 1972*, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, Ch. 487, §14; Laws, 1991, Ch. 423, §1; Laws, 1992, Ch. 519, §4 eff. from and after July 1, 1992; Strengthening Career and Technical Education for the 21st Century Act, 2019 [Perkins V]; and Every Student Succeeds Act, 2015).

Mississippi Teacher Professional Resources

The following are resources for Mississippi teachers:

Curriculum, Assessment, Professional Learning

- Program resources can be found at the RCU's website, rcu.msstate.edu.

Learning Management System: An Online Resource

- Learning management system information can be found at the RCU's website, under Professional Learning.

Should you need additional instructions, contact the RCU at 662.325.2510 or helpdesk@rcu.msstate.edu.

Executive Summary

Pathway Description
The Diversified Agriculture—Mechanization Core curriculum is a one-Carnegie unit course within the four-credit Diversified Agriculture pathway. All students must successfully complete the Principles of Agriscience prerequisite course before enrolling in this course. Emphasis in this document is centered on teaching advanced skills in mechanization as they apply to various aspects of an agricultural work environment. Students will attain advanced knowledge and skills in areas such as electricity, welding and fabrication, hydraulics and pneumatics, as well as the management and operation of agricultural equipment. Focus is on an active learning environment enriched with technology, engineering, and math-based applications.

College, Career, and Certifications
No national industry-recognized certifications are utilized in Mississippi pertaining to the agriculture industry. Competencies and suggested objectives in this course have been correlated, however, to the National AFNR Career Cluster Content Standards that have been reviewed and endorsed at the national level by the National Council on Agricultural Education.

Grade Level and Class Size Recommendations
It is recommended that students enter this program as tenth graders. Exceptions to this are a district-level decision based on class size, enrollment numbers, student maturity, and CTE delivery method. This is a hands-on, lab- or shop-based course. Therefore, a maximum of 15 students is recommended per class, and teachers should only teach one subject per class period.

Student Prerequisites
For students to experience success in the program, the following student prerequisites are suggested:

1. C or higher in English (the previous year)
2. C or higher in high school-level math (last course taken, or the instructor can specify the level of math instruction needed)
3. Instructor approval

or

1. Instructor approval

Assessment
The latest assessment blueprint for the curriculum can be found at rcu.msstate.edu/curriculum/.

Applied Academic Credit
The latest academic credit information can be found at mdek12.org/secondaryeducation/approved-courses/.

Educator Licensure
The latest educator licensure information can be found at mdek12.org/licensure/.

Professional Learning
If you have specific questions about the content of any training sessions provided, please contact the RCU at 662.325.2510 or helpdesk@rcu.msstate.edu.

Course Outlines

This curriculum consists of one 1-credit course.

Diversified Agriculture—Mechanization Core–Course Code: 993426

Unit	Title	Hours
1	Leadership and SAE for All	5
2	Safety in Agricultural Mechanics	10
3	Introduction to Agricultural Mechanization	10
4	Oxyfuel and Plasma-Cutting Operations	20
5	Principles of Welding	20
6	Hydraulic and Pneumatic Systems in Agriculture	10
7	Electrical Systems Applications in Agriculture	10
8	Principles of Engines	30
9	Service, Management, and Operation of Agricultural Equipment	25
Total		**140**

Career Pathway Outlook

Overview

The Agriculture career cluster encompasses a wide range of occupations focused on the production and use of plants and animals for food, fiber, aesthetic, and environmental purposes. A USDA-funded study (Purdue University, 2024–2025) is producing updated five-year national projections for employment opportunities in food, agriculture, renewable natural resources, and the environment for graduates with bachelor's degrees or higher. According to the U.S. Bureau of Labor Statistics (2023), employment of agricultural and food scientists is projected to grow 8% from 2023 to 2033, with approximately 3,100 annual openings primarily due to retirements and occupational transfers. As in previous USDA reports, nearly half of the employment openings are expected in management and business (approximately 42%), followed by science, technology, engineering, and math (31%), sustainable production and biomaterials (13%), and education, communication, and government services (14%) (Purdue University, 2020).

Agriculture, food, and related industries contributed $1.1 trillion to the U.S. gross domestic product (GDP) in 2019 (USDA Economic Research Service, 2020). Projections through 2033 forecast continued growth in farm income, trade, and sector indicators (USDA Economic Research Service, 2024). In Mississippi, agriculture remains the top industry. The total value of agricultural production increased to approximately $9 billion in 2024 (Mississippi State University Extension, 2024), up from $7.8 billion in 2022. The agriculture, forestry, fishing, and hunting sector contributed $4.156 billion to the state's GDP in Q4 2024 (Federal Reserve Bank of St. Louis, 2024). According to the Mississippi Department of Agriculture and Commerce (2024), agriculture directly or indirectly employs about 11.4% of Mississippi's workforce.

Needs of the Future Workforce

Data for this synopsis were compiled from the Mississippi Department of Employment Security (MDES) (2025). Employment opportunities for each of the occupations are listed below:

Table 1.1: Current and Projected Occupation Report

Description	Jobs, 2022	Projected Jobs, 2032	Change (Number)	Change (Percent)	Average Yearly Earnings, 2025
Agricultural and Food Science Technicians	250	270	20	8.0%	$42,081
Agricultural Sciences Teachers, Postsecondary	150	160	10	6.7%	$93,622
Animal Trainers	100	110	10	10%	$29,230
Career/Technical Education Teachers, Middle School	230	240	10	4.3%	$51,425
Career/Technical Education Teachers, Secondary School	1220	1310	90	7.4%	$51,416
Conservation Scientists	1250	1260	10	0.8%	$54,950
Environmental Engineers	410	420	10	2.4%	$75,940

Environmental Engineering Technicians	70	70	—	—	$46,790
Environmental Scientists and Specialists, Including Health	270	280	10	3.7%	$64,460
Environmental Science and Protection Technicians, Including Health	30	30	—	—	$38,780
Farm and Home Management Advisors	290	300	10	3.2%	$38,650
Logging Equipment Operators	1,680	1,740	60	3.6%	$41,840
Landscaping and Groundskeeping Workers	6,000	6,620	620	10.3%	$25,630
Nonfarm Animal Caretakers	1,520	1,780	260	17.1%	$24,030
Soil and Plant Scientists	110	110	—	—	$92,250
Farmers, Ranchers, and Other Agricultural Managers	6730	6930	200	3.0%	$55,830
First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	980	1090	110	11.2%	$40,270
First-Line Supervisors/Managers of Farming, Fishing, and Forestry Workers	940	990	50	5.3%	$54,550
Fish and Game Wardens	40	40	—	—	$46,610
Foresters	180	180	—	—	$52,660
Surveyors	380	410	30	7.9%	$48,600
Surveying and Mapping Technicians	670	720	50	7.5%	$39,840
Tree Trimmers and Pruners	270	300	30	11.1%	$44,920
Veterinarians	490	540	50	10.2%	$81,950
Veterinary Assistants and Laboratory Animal Caretakers	970	1090	120	12.4%	$26,150
Veterinary Technologists and Technicians	570	630	60	10.5%	$35,890
Zoologists and Wildlife Biologists	230	250	20	8.7%	$70,200

Source: Mississippi Department of Employment Security; mdes.ms.gov (2025).

Perkins V Requirements and Academic Infusion

The Diversified Agriculture—Mechanization Core curriculum meets Perkins V requirements of introducing students to and preparing them for high-skill, high-wage occupations in agricultural fields. It also offers students a program of study, including secondary, postsecondary, and higher education courses, that will further prepare them for agricultural careers. Additionally, this curriculum is integrated with academic college- and career-readiness standards. Lastly, it focuses on ongoing and meaningful professional development for teachers as well as relationships with industry.

Transition to Postsecondary Education

The latest articulation information for secondary to postsecondary can be found at the Mississippi Community College Board website, mccb.edu.

Best Practices

Innovative Instructional Technologies

Classrooms should be equipped with tools that will teach today's digital learners through applicable and modern practices. The Diversified Agriculture—Mechanization Core educator's goal should be to include teaching strategies that incorporate current technology. To make use of the latest online communication tools—wikis, blogs, podcasts, and social media platforms, for example—the classroom teacher is encouraged to use a learning management system that introduces students to education in an online environment and places more of the responsibility of learning on the student.

Differentiated Instruction

Students learn in a variety of ways, and numerous factors—students' background, emotional health, and circumstances, for example—create unique learners. By providing various teaching and assessment strategies, students with various learning preferences can have more opportunities to succeed.

CTE Student Organizations

Teachers should investigate opportunities to sponsor a student organization. The National FFA Organization is the student organization for this pathway and will foster the types of learning expected from the Diversified Agriculture—Mechanization Core curriculum. FFA provides participants and members with growth opportunities and competitive events. They also open the doors to the world of agriculture careers and scholarship opportunities.

Cooperative Learning

Cooperative learning can help students understand topics when independent learning cannot. Therefore, you will see several opportunities in the Diversified Agriculture—Mechanization Core curriculum for group work. To function in today's workforce, students need to be able to work collaboratively with others and solve problems without excessive conflict. This curriculum provides opportunities for students to work together and help each other complete complex tasks. There are many field experiences within the Diversified Agriculture—Mechanization Core curriculum that will allow and encourage collaboration with professionals currently in the agriculture field.

Work-Based Learning

Work-based learning is an extension of understanding competencies taught in the Diversified Agriculture—Mechanization Core classroom. The Diversified Agriculture pathway requires students to obtain clinical-type hours during Capstone, which may include, but are not limited to, clinicals, worksite field experiences, entrepreneurship, internships, pre-apprenticeships, school-based enterprises, job placements, and simulated worksites. These real-world connections and applications provide a link to all types of students regarding knowledge, skills, and professional dispositions. Thus, supervised collaboration and immersion into the

agriculture industry are keys to students' success, knowledge, and skills development. For more information on embedded WBL, visit the Mississippi Work-Based Learning Manual on the RCU website, rcu.msstate.edu.

Professional Organizations

American Association for Agricultural Education (AAAE)
aaaeonline.org

Association for Career and Technical Education (ACTE)
acteonline.org

Mississippi Association for Career and Technical Education (MSACTE)
mississippiacte.com

Mississippi Association of Agricultural Educators (MSAAE)
mississippiffa.org

National Association of Agricultural Educators (NAAE)
naae.org

National FFA Organization
ffa.org

Using This Document

Competencies and Suggested Objectives
A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies. The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.

Teacher Resources
All teachers should request to be added to the Canvas Resource Guide for their course. For questions or to be added to the guide, send a Help Desk ticket to the RCU by emailing helpdesk@rcu.msstate.edu.

Perkins V Quality Indicators and Enrichment Material
Some of the units may include an enrichment section at the end. This material will greatly enhance the learning experiences of students. If the Diversified Agriculture—Mechanization Core program is using a national certification, work-based learning, or another measure of accountability that aligns with Perkins V as a quality indicator, this material could very well be assessed on that quality indicator. It is the responsibility of the teacher to ensure all competencies for the selected quality indicator are covered throughout the year.

Unit 1: Leadership and SAE for All

Competencies and Suggested Objectives
1. Participate in local, state, and/or national FFA activities that provide opportunities for leadership development and career exploration. DOK3 a. Actively participate in FFA activities. • Leadership Development Events (LDE) • Career Development Events (CDE) o Agricultural Technology and Mechanical Systems • Tractor operations and maintenance contest • Arc welding contest • Agricultural mechanics showcase • Leadership retreats or conferences • Industry-related seminars, workshops, or conferences • Other related FFA activities
2. Identify potential college and career opportunities in agricultural mechanics. DOK1 a. Identify and demonstrate 21st-century skills, including but not limited to: • Communication • Collaboration • Employability skills • Financial literacy • Problem solving • Responsibility • Social skills b. Research postsecondary institutions that offer studies in agricultural mechanics or a related field and prepare a two- to three-minute speech on their programs and potential career choices. c. Complete applications for college admission and scholarships. d. Revise a personal résumé for the purpose of applying for a specific job. e. Complete a job application for employment. f. Participate in a mock or real interview.
3. Review the types of programs under Supervised Agricultural Experience (SAE) for All. DOK1 a. Explore concepts of a Foundational SAE. • Career exploration and planning • Employability skills for college and career readiness • Personal financial management and planning • Workplace safety • Agricultural literacy b. Explore concepts of an Immersion SAE. • Placement/internship • Ownership/entrepreneurship • Research o Experimental o Analytical o Invention • School-based enterprise

- Service learning

4. Review individual plans for student Foundational SAE programs. DOK2
   a. Assess goal attainment in SAE from the previous year.
   b. Review and update short- and long-range goals pertaining to the SAE program.
5. Develop an Immersion SAE and maintain agricultural records. DOK2
   a. Redefine and adjust requirements of agreements between the student, parents, supervisor, and/or employer.
   b. Utilize an electronic/computer-based system of record keeping.
   c. Update SAE records.
      - SAE program goals
      - Student inventory related to the SAE program
      - Expense records
      - Income/gift and scholarship records
      - Skill-attainment records
      - Leadership-activity records and participation in FFA activities
      - Community service hours
   d. Complete degree and proficiency award applications as they apply to the SAE.

Unit 2: Safety in Agricultural Mechanics

Competencies and Suggested Objectives
1. Apply and demonstrate general laboratory and shop safety requirements for agricultural mechanics. DOK1 a. Describe personal safety rules for working in the laboratory and/or agricultural mechanics industry. • Eye safety law • Personal protective equipment (PPE) • Behavior in the shop/lab environment and liability • Maintaining shop/lab cleanliness and organization b. Describe general workplace safety rules per safety organizations' standards. • Procedures for materials handling, including lifting heavy objects and storage • Procedures for shop equipment operation • Safe work requirements for elevated work, including fall-prevention guidelines • How to avoid struck-by hazards • How to identify common energy-related hazards and how to avoid these hazards • Other specific job safety procedures (fires, environmental extremes, etc.) c. Identify standard industry safety color code scheme. • Red • Orange • Yellow • Green • Blue • White • Magenta and yellow or black and yellow d. Describe accident reporting procedures.
2. Investigate Occupational Safety and Health Administration (OSHA) regulations and complete certification, if applicable. DOK2
3. Identify hazardous materials that may be found in the laboratory or on a job site and describe procedures for handling/avoidance or removal of materials. DOK2 a. Explain the purpose and use of Safety Data Sheets (SDS). b. Review an SDS form to identify safe handling and disposal procedures for hazardous materials. c. Demonstrate procedures for posting and filing SDS forms. d. Describe the approved storage procedures for flammable materials found in the agricultural mechanics laboratory. e. Describe approved procedures for disposal of hazardous materials. f. Demonstrate safe procedures for the use and storage of batteries.
4. Demonstrate the selection and use of hand tools in agricultural mechanics. DOK2 a. Identify basic hand tools, including metric and standard where applicable, used in agricultural mechanics. • Wrenches • Sockets and accessories • Screwdrivers • Pliers

- Hammers
- Punches
- Chisels

b. Demonstrate the selection and use of hand tools in agricultural mechanics.

5. Demonstrate the proper use of portable power tools found in the laboratory or shop. DOK3
   a. Identify types of portable power tools used in agricultural mechanics.
      - Grinders (portable angle or detail)
      - Drills or drivers (hammer, electric, etc.)
      - Saws (circular, reciprocating, portable band saw, and abrasive [miter/cutoff] saw)
      - Presses
      - Pneumatic tools (ratchets, nail gun, impact)
      - Pneumatic nail gun
      - Pavement breaker (pneumatic or air)
   b. Demonstrate safety procedures for the use of portable power tools used in agricultural mechanics.
   c. Demonstrate the use of portable power tools used in the agricultural mechanics laboratory.
6. Demonstrate the proper use of stationary tools used in agricultural mechanics. DOK3
   a. Identify stationary tools used in the agricultural mechanics laboratory.
      - Band saws
      - Drill presses
      - Hydraulic shears
      - Pedestal or bench grinders
      - Abrasive cut-off saws
      - Hydraulic benders
   b. Describe the functions of stationary power tools used in agricultural mechanics.
   c. Describe the safety rules of stationary power tools used in agricultural mechanics.
   d. Demonstrate the use of each stationary power tool used in agricultural mechanics.
   e. Perform maintenance procedures on each stationary power tool used in agricultural mechanics.
7. Demonstrate the proper use of lifting, hoisting, and supporting equipment. DOK3
   a. Identify lifting, hoisting, and supporting equipment.
      - Jacks
      - Jack stands
      - Hoists
      - Floor cranes
      - Overhead cranes
      - Chains and slings
   b. Demonstrate safety rules for using lifting, hoisting, and supporting equipment.
   c. Demonstrate use of lifting, hoisting, and supporting equipment.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be geared toward the specific school's needs, tools, facilities, etc. This test should be documented in each student's file.

Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 3: Introduction to Agricultural Mechanization

Competencies and Suggested Objectives
1. Describe the role of mechanical technology in agriculture. DOK1 a. Discuss how mechanization and technology have changed the production of food and fiber. b. Describe the role of emerging technologies in agricultural mechanization. c. Define power and discuss how it is generated and measured. • Internal combustion engine • Electric motor • Hydraulic systems • Pneumatic systems
2. Apply workforce ready math skills related to the industry. DOK2 a. Describe standard and metric units for measuring distance, area, weight, temperature, and volume. b. Convert measurements from metric to standard units. c. Convert decimals to fractions. d. Convert fractions to decimals. e. Calculate the area of 2-D shapes and volume of 3-D shapes. f. Use graduated containers to measure and calculate amounts of standard and metric liquid measurements. g. Use a speed/combination square to measure and mark angles.
3. Read and interpret technical plans for constructing a simple project (e.g., bird house, bench, toolbox, jewelry box, etc.). DOK2 a. Apply information from the plan in selection of project materials. b. Construct the project based on the plan details.

Mississippi Career Connections
To build, repair, and maintain equipment and structures, professionals within the agricultural mechanics industry rely heavily on accurate math skills. A local Mississippi agricultural business is seeking student interns and requires applicants to complete a pre-assessment demonstrating their ability to perform common shop calculations. As part of the internship screening, students must complete the following tasks: • Unit Conversions: Convert lumber dimensions, tool measurements, or equipment specifications between standard and metric units. • Fractions & Decimals: Convert fractional lumber or metal measurements into decimals for precise cutting and layout (e.g., 7 ¾ in.). • Area & Volume: Calculate the area of a concrete slab and determine the volume of needed materials (e.g., concrete in cubic feet → cubic yards, gravel in cubic inches → cubic feet). • Liquid Measurement: Use graduated containers to measure hydraulic fluid, oil, coolant, or chemical solutions in both standard and metric units. • Angles & Layout: Use a speed/combination square to mark angles such as 45° and 90° for a simple layout line or component template.

Unit 4: Oxyfuel and Plasma-Cutting Operations

Competencies and Suggested Objectives
1. Explain and apply fire safety procedures in cutting operations. DOK2 a. Identify the location of firefighting equipment. b. Identify classes of fires and associated equipment for each class. c. Identify exit locations in case of emergency.
2. Identify and describe major oxyfuel equipment and its uses. DOK1 a. Explore the major uses of oxyfuel equipment (e.g., cutting, heating, brazing/welding).
3. Assemble and handle oxyfuel cutting equipment. DOK2 a. Identify parts of the oxyfuel cutting equipment. • Regulators • Hoses • Fittings • Torch body • Tips • Accessories • Flashback arrestor b. Discuss safety procedures for setting up oxyfuel equipment. c. Assemble oxyfuel equipment, purge lines, and test for leaks. d. Demonstrate procedures for safe handling and storage of oxyfuel cylinders and equipment.
4. Demonstrate safe usage of oxyfuel equipment to perform cuts. DOK3 a. Demonstrate safety procedures for operating oxyfuel equipment. b. Demonstrate procedures for lighting an oxyfuel torch and setting regulator pressures. c. Identify oxidizing, carburizing, and neutral flames. d. Demonstrate how to produce a neutral flame. e. Demonstrate procedures to cut mild steel. • Straight cut • Bevel cut • Piercing cut f. Demonstrate how to adjust the cutting flame based on the appearance of drag lines on the metal.
5. Demonstrate safe plasma-cutting procedures. DOK3 a. Demonstrate safety procedures and select the correct PPE for plasma cutting. b. Identify and describe the function of the different parts of the plasma-cutting unit. • Machine • Compressed air/gas • Electrode • Torch body • Cutting tip • Ground cable and clamp c. Set up, ignite, and shut down plasma-cutting equipment. d. Describe the characteristics and uses of the plasma-cutting machine. e. Demonstrate how to cut a mild steel plate.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be geared toward the specific school's needs, tools, facilities, etc. This test should be documented in each student's file.

Unit 5: Principles of Welding

Competencies and Suggested Objectives

1. Analyze and apply basic equipment, operations, procedures, and safety precautions of arc welding. DOK2
   a. Identify and describe the function and use of PPE and apparel (e.g., clothing, gloves, helmets, lens shades, safety glasses/goggles).
   b. Discuss and demonstrate the safety procedures used to prevent electrical shock, eye and skin damage, and respiratory damage while welding.
   c. List the major types of welding used in agricultural equipment repair and fabrication and discuss their characteristics and applications.
      - Shielded metal arc welding (SMAW)
      - Gas metal arc welding (GMAW) or metal inert gas (MIG)
      - Gas tungsten arc welding (GTAW) or tungsten inert gas (TIG)
      - Flux core arc welding (FCAW)
   d. Describe the purpose/function of tools and accessories used in welding.
      - Electrode holder
      - Ground clamp
      - Cables
      - Electrodes
      - Wire
      - Chipping hammer
      - Wire brush
   e. Associate common SMAW electrodes and GMAW wire with their weld characteristics and proper use.
   f. Examine the relationship of amperage, voltage, and electrode type and diameter to electrode and metal type and thickness.
   g. Discuss common GMAW shielding gases.
   h. Identify the two types of welds (i.e., fillet [F] and groove [G]).
   i. Identify the difference between a stringer bead and a weave bead.
   j. Identify the five different types of weld joints (i.e., butt, lap, t-weld, corner, and edge).
   k. Compare welding procedures for welding in different welding positions.
      - 1-Flat
      - 2-Horizontal
      - 3-Vertical
      - 4-Overhead
   l. Identify weld symbols as they are incorporated into blueprints, plans, or drawings (e.g., 1G is a flat-groove weld, 2F is a horizontal-fillet weld).

2. Perform welding techniques using SMAW and metal inert gas MIG. DOK2
   a. Demonstrate the procedure for striking an arc and running a flat bead.
   b. Demonstrate procedures to construct a butt weld in the following positions.
      - Flat
      - Horizontal
      - Vertical
   c. Demonstrate procedures to construct a fillet weld in the following positions.

- Flat
- Horizontal
- Vertical

3. Apply skills in welding to complete a welding project (e.g., metal gate, grooming stand, small grill, etc.). DOK3

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be geared toward the specific school's needs, tools, facilities, etc. This test should be documented in each student's file.

Mississippi Career Connections

Using the *Mississippi FFA Arc Welding Handbook*, set up a mock welding event that mirrors the official competition. Utilize the Arc Welding Score Card as a rubric to evaluate student performance. Invite local business and industry partners from the welding and fabrication field to serve as judges, offering students authentic, industry-based feedback to help them refine their welding skills and understand the real-world expectations of the workforce.

Unit 6: Hydraulic and Pneumatic Systems in Agriculture

Competencies and Suggested Objectives
1. Explore principles of hydraulics and pneumatics. DOK2 a. Identify major components of hydraulic and pneumatic systems, their purpose, and functions. • Reservoir • Pump • Control valves • Check valves • Filter • Lines • Cylinders (single and double action) • Compressors (single spring and double spring action) • Lever • Pressure gauges b. Describe and apply *Pascal's law* and *Boyle's law*. c. Compare and contrast the operation of a pneumatic system to the operation of a hydraulic system. d. Demonstrate the operation of a pneumatic system to perform work. e. Demonstrate the operation of a hydraulic system to perform work.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be geared toward the specific school's needs, tools, facilities, etc. This test should be documented in each student's file.

Unit 7: Electrical Systems Applications in Agriculture

Competencies and Suggested Objectives
1. Describe and apply the use of electrical components and systems in agricultural equipment. DOK2 a. Identify common symbols, schematics, and drawings of electrical systems. • Fuse • Circuit breaker • Battery • Relay • Ammeter • Resistor • Push-button switch • Single-receptacle outlet • Single-pole switch • Double-pole switch • Three-way switch • Ground connection • Wire identification, type, and size codes • Schematic for a branch circuit b. Measure resistance, voltage, and current in a circuit using a multimeter. c. Calculate resistance, voltage, and current in a circuit using *Ohm's law*. d. Compare the functions of basic electrical devices. • Conductors • Switches • Service entrance panel • Breaker • Receptacle • Light
2. Describe and classify the functions of electric and electronic devices, such as conductors and switches. DOK2
3. Analyze and apply alternating current (AC) wiring techniques. DOK2 a. Install and demonstrate the operation of basic AC circuits used in agricultural mechanics. • Single-pole switch and light • Receptacle • Three-way switch and light • Single-pole switch, light, and receptacle

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be geared toward the specific school's needs, tools, facilities, etc. This test should be documented in each student's file.

Unit 8: Principles of Engines

Competencies and Suggested Objectives

1. Describe the major system functions and operations of a small gasoline engine. DOK2
   a. Discuss and apply safety principles while working on engines.
   b. Describe the basic principles of combustion and force as applied to an internal combustion engine.
   c. Compare and contrast the operating principles of four- and two-stroke gasoline engines.
      - Four-stroke
        - Intake
        - Compression
        - Power
        - Exhaust
      - Two-stroke
        - Intake/compression
        - Power/exhaust
   d. Compare and contrast the operating principles of gasoline and diesel engines.
   e. Describe the types of lubrication systems.
      - Splash
      - Pressurized (e.g., plunger and rotary)
   f. Select proper lubricants and fuels based on the manufacturer's recommendation.
      - Calculate ratios of oil and gasoline and mix fuel for a two-cycle engine.
      - Discuss ethanol versus non-ethanol fuels.
   g. Describe the types of air- and liquid-cooled engine cooling systems.
      - Air-cooling fins
      - Liquid cooled
        - Water pump
        - Radiator cap
        - Radiator
        - Thermostat
      - Discuss types and classifications of coolants and the importance of the pressurized cooling system.
   h. Describe the parts and functions of a small gasoline engine fuel system.
      - Carburetor
      - Tank
      - Pump/gravity flow
      - Filter
   i. Describe the parts and functions of a small gasoline engine ignition system.
      - Spark plug
      - Ignition coil
      - Switch
      - Power source (battery pull rope)

2. Compare and contrast the major system functions and operations of diesel and small gasoline engines. DOK2 a. Discuss and apply safety principles while working on engines. b. Describe the basic principles of combustion and force as applied to an internal combustion diesel engine.
3. Disassemble, inspect, and reassemble a small gasoline engine. DOK3 a. Disassemble a small gasoline engine, including removing the head, oil pan, piston and crankshaft assembly, and valves. b. Inspect and measure parts of the engine to verify it is within the tolerances set by the manufacturer. c. Reassemble the engine and test for proper operation (e.g., compression, ignition).

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be geared toward the specific school's needs, tools, facilities, etc. This test should be documented in each student's file.

Unit 9: Service, Management, and Operation of Agricultural Equipment

Competencies and Suggested Objectives

1. Describe the importance of machinery management and maintenance. DOK1
2. Demonstrate recommended maintenance practices, apply proper safety and operational skills, and develop diagnostic abilities to perform recommended maintenance on agricultural equipment. DOK3
   a. Identify common equipment controls and describe their use and function.
      - Throttle
      - Clutch
      - Brakes
      - Hydraulic valves
      - Transmission shift controls
   b. Demonstrate the procedures for pre-inspection and start-up of equipment with an internal combustion engine.
      - Locate and interpret operation procedures in the owner's manual.
      - Check the fuel level.
      - Check the fuel shut-off valve or key.
      - Check for obstructions.
      - Check the coolant fluid level if liquid cooled, or the fins if air cooled.
      - Check the tire inflation.
      - Check the brakes.
      - Check the clutch.
      - Adjust the seat and fasten the seat belt.
      - Adjust the steering.
      - Check the throttle.
      - Complete an operational inspection.
      - Check the oil pressure during operation.
      - Check the ammeter during operation.
      - Check the temperature gauge during operation.
      - Check the fuel level during operation.
      - Wear a seat belt at all times.
      - Demonstrate smooth clutch engagement.
      - Shift gears cleanly.
      - Avoid stalling the engine.
      - Avoid excessive engine speed.
      - Avoid excessive tractor speed.
      - Avoid unsafe conduct during operation.
3. Demonstrate recommended maintenance practices for agricultural equipment. DOK3
   a. Discuss the meaning of preventative maintenance.
   b. Locate and interpret preventative maintenance information in the owner's manual.
   c. Perform maintenance routines by inspecting and servicing the following components of agricultural equipment:
      - Air cleaner
      - Lubrication system
      - Fuel system

- Belts and hoses
- Liquid coolant system
- Hydraulic system

d. Complete a work order for a given repair or maintenance procedure and calculate the cost of the repair.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be geared toward the specific school's needs, tools, facilities, etc. This test should be documented in each student's file.

Mississippi Career Connections

The Mississippi Tractor Operations & Maintenance CDE provides senior FFA members with practical experience in essential tractor skills. Teams of two demonstrate proper maintenance practices, safe operational techniques, and diagnostic and repair procedures on modern diesel tractors. Emphasizing safety, teamwork, and technical skills, this event reinforces classroom instruction while preparing students for future roles in production agriculture and equipment maintenance. Agriculture is recognized as one of Mississippi's high-priority sectors, with strong demand for machinery operation and maintenance skills across the state. Participation in this event helps build a pipeline of career-ready operators and technicians, equipping students with the competencies necessary to transition directly into the workforce upon high school graduation.

Student Competency Profile

Student's Name: _____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student, and it can serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date (MM/DD/YY) on which the student mastered the competency.

Unit 1: Leadership and SAE for All		
	1.	Participate in local, state, and/or national FFA activities that provide opportunities for leadership development and career exploration.
	2.	Identify potential college and career opportunities in agricultural mechanics.
	3.	Review the types of programs under Supervised Agricultural Experience (SAE) for All.
	4.	Review individual plans for student Foundational SAE programs.
	5.	Develop an Immersion SAE and maintain agricultural records.
Unit 2: Safety in Agricultural Mechanics		
	1.	Apply and demonstrate general laboratory and shop safety requirements for agricultural mechanics.
	2.	Investigate Occupational Safety and Health Administration (OSHA) regulations and complete certification, if applicable.
	3.	Identify hazardous materials that may be found in the laboratory or on a job site and describe procedures for handling/avoidance or removal of materials.
	4.	Demonstrate the selection and use of hand tools in agricultural mechanics.
	5.	Demonstrate the proper use of portable power tools found in the laboratory or shop.
	6.	Demonstrate the proper use of stationary tools used in agricultural mechanics.
	7.	Demonstrate the proper use of lifting, hoisting, and supporting equipment.
Unit 3: Introduction to Agricultural Mechanization		
	1.	Describe the role of mechanical technology in agriculture.
	2.	Apply workforce ready math skills related to the industry.
	3.	Read and interpret technical plans for constructing a simple project (e.g., bird house, bench, toolbox, jewelry box, etc.).
Unit 4: Oxyfuel and Plasma-Cutting Operations		
	1.	Explain and apply fire safety procedures in cutting operations.
	2.	Identify and describe major oxyfuel equipment and its uses.
	3.	Assemble and handle oxyfuel cutting equipment.
	4.	Demonstrate safe usage of oxyfuel equipment to perform cuts.
	5.	Demonstrate safe plasma-cutting procedures.

Unit 5: Principles of Welding		
	1.	Analyze and apply basic equipment, operations, procedures, and safety precautions of arc welding.
	2.	Perform welding techniques using SMAW and metal inert gas MIG.
	3.	Apply skills in welding to complete a welding project (e.g., metal gate, grooming stand, small grill, etc.).
Unit 6: Hydraulic and Pneumatic Systems in Agriculture		
	1.	Explore principles of hydraulics and pneumatics.
Unit 7: Electrical Systems Applications in Agriculture		
	1.	Describe and apply the use of electrical components and systems in agricultural equipment.
	2.	Describe and classify the functions of electric and electronic devices, such as conductors and switches.
	3.	Analyze and apply alternating current (AC) wiring techniques.
Unit 8: Principles of Engines		
	1.	Describe the major system functions and operations of a small gasoline engine.
	2.	Compare and contrast the major system functions and operations of diesel and small gasoline engines.
	3.	Disassemble, inspect, and reassemble a small gasoline engine.
Unit 9: Service, Management, and Operation of Agricultural Equipment		
	1.	Describe the importance of machinery management and maintenance.
	2.	Demonstrate recommended maintenance practices, apply proper safety and operational skills, and develop diagnostic abilities to perform recommended maintenance on agricultural equipment.
	3.	Demonstrate recommended maintenance practices for agricultural equipment.

Appendix A: Industry Standards

AFNR Pathway
Content Standards and Performance Elements

The AFNR Pathway Content Standards and Performance Elements are adapted from *AFNR Agriculture, Food, and Natural Resources Content Standards.* Reprinted with permission from the National Council for Agricultural Education, 6060 FFA Drive Indianapolis, IN 46268, 317.802.4206. Copyright © 2024. A complete copy of the national standards can be downloaded from the Team Ag Ed Learning Center at thecouncil.ffa.org/afnr/.

	Units								
Standards	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
ABS - Agribusiness Systems	X								X
AS - Animal Systems									
BS - Biotechnology Systems									
CRP - Career Ready Practices	X	X	X	X	X	X	X	X	X
ECL - Education, Communication, and Leadership	X								
ESS - Environmental Sustainability Systems		X							
FPP - Food Products and Processing Systems									
FPS - Foundational Pathway Skills	X	X	X	X	X	X	X	X	X
NRS - Natural Resource Systems									
PS - Plant Systems									
PST - Power, Structural, and Technical Systems		X	X	X	X	X	X	X	X

Agribusiness Systems
Career Pathway Content Standards

The Agribusiness Systems (ABS) Career Pathway encompasses the study of agribusinesses and their management including, but not limited to, record keeping, budget management (cash and credit), business planning, introduction to micro- and macroeconomic principles, and sales and marketing. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the planning, development, application, and management of agribusiness systems in AFNR settings.

Within each pathway, the standards are organized as follows:

- ***Standards***– These are the standards owned by Advance CTE and used here with permission. The standards defined the scope and guided the development of the updated indicators and sample measurements.
- ***Performance Indicators*** – These statements distill each standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related standard at the conclusion of a program of study in this area.

ABS.01. Apply management planning principles in AFNR businesses.

ABS.01.01. Apply economic principles to plan and manage inputs and outputs in an AFNR business.
ABS.01.02. Evaluate and create statements of purpose and business goals for AFNR businesses.
ABS.01.03. Develop and apply skills to manage an AFNR business in an efficient, legal, and ethical manner.

ABS.01.04. Evaluate, develop, and implement procedures used to recruit, train, and retain productive human resources for AFNR businesses.

ABS.02. Use record keeping to accomplish AFNR business objectives, manage budgets and comply with laws and regulations.
ABS.02.01. Apply fundamental accounting principles, systems, tools, and applicable laws and regulations to record, track, and audit AFNR business transactions (e.g., accounts, debits, credits, assets, liabilities, equity, etc.).
ABS.02.02. Assemble, interpret, and analyze financial information and reports to monitor AFNR business performance and support decision-making (e.g., income statements, balance sheets, cash-flow analysis, inventory reports, break-even analysis, return on investment, taxes, etc.).

ABS.03. Manage cash budgets, credit budgets and credit for an AFNR business using generally accepted accounting principles.
ABS.03.01. Manage cash budgets, assets, Employment Tax Incentive opportunities for credits, loans, etc. to achieve AFNR business goals.
ABS.03.02. Analyze credit needs and manage credit budgets to achieve AFNR business goals.

ABS.04. Develop a business plan for an AFNR business.
ABS.04.01. Analyze characteristics and planning requirements associated with developing business plans for different types of AFNR businesses.
ABS.04.02. Develop production and operational plans for an AFNR business.
ABS.04.03. Identify and apply strategies to manage or mitigate risk.

ABS.05. Use sales and marketing principles to accomplish AFNR business objectives.
ABS.05.01. Determine the role of markets, trade, competition, and price in relation to AFNR business sales and marketing plan.
ABS.05.02. Assess and apply sales principles and skills to accomplish AFNR business objectives.
ABS.05.03. Assess marketing principles and develop marketing plans to accomplish AFNR business objectives.

Animal Systems
Career Pathway Content Standards

The Animal Systems (AS) Career Pathway encompasses the study of animal systems, including content areas such as life processes, health, nutrition, genetics, management, processing, and veterinary science, as applied to small animals, aquaculture, exotic animals, livestock, dairy, horses and/or poultry. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the development, application and management of animal systems in AFNR settings.

Within each pathway, the standards are organized as follows:
- ***Standards***– These are the standards owned by Advance CTE and used here with permission. The standards defined the scope and guided the development of the updated indicators and sample measurements.
- ***Performance Indicators*** – These statements distill each standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related standard at the conclusion of a program of study in this area.

AS.01. Analyze historic and current trends impacting the animal systems industry.
AS.01.01. Evaluate the development and implications of animal origin, domestication, and distribution on production practices and the environment.
AS.01.02. Assess and select animal production, marketing, and management methods based upon effectiveness and potential social and environmental impacts.
AS.01.03. Analyze laws and sustainable practices that impact animal agriculture from a local, tribal, state, national, and global perspective.

AS.02. Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.
AS.02.01. Explain management techniques that ensure animal welfare.
AS.02.02. Analyze procedures to ensure that animal products are safe for consumption.

AS.03. Design and provide proper animal nutrition to achieve desired outcomes for performance, development, reproduction and/or economic production.

AS.03.01. Analyze the nutritional needs of animals.
AS.03.02. Analyze feed rations and assess if they meet the nutritional needs of animals.
AS.03.03. Utilize tools, equipment, techniques, and technology to make animal nutrition decisions.

AS.04. Apply principles of animal reproduction to achieve desired outcomes for performance, development and/or economic production.

AS.04.01. Evaluate animals for breeding readiness and soundness.
AS.04.02. Apply scientific principles to select and care for breeding animals.
AS.04.03. Apply scientific principles to animal breeding.

AS.05. Evaluate environmental factors affecting animal performance and implement procedures for enhancing performance and animal health.

AS.05.01. Design and evaluate animal housing, equipment, and handling facilities for the major systems of animal production.
AS.05.02. Comply with government regulations and safety standards for facilities used in animal production.

AS.06. Classify, evaluate and select animals based on anatomical and physiological characteristics.

AS.06.01. Classify animals according to taxonomic classification systems and use (e.g., agricultural, companion, etc.).
AS.06.02. Apply principles of comparative anatomy and physiology to uses within various animal systems.
AS.06.03. Select animals for specific purposes and maximum performance based on anatomy and physiology.

AS.07. Apply principles of effective animal health care.

AS.07.01. Design programs to prevent animal diseases, parasites, and other disorders and ensure animal welfare.
AS.07.02. Analyze biosecurity measures utilized to protect the welfare of animals and health of humans on a local, state, national, and global level.

AS.08. Analyze environmental factors associated with animal production.

AS.08.01. Design management practices related to animal agriculture to enhance the environment.
AS.08.02. Evaluate the effects of environmental conditions on animals.

Biotechnology Systems
Career Pathway Content Standards

The Biotechnology Systems (BS) Career Pathway encompasses the study of using scientific techniques to gather and analyze data to solve problems concerning living organisms with an emphasis on applications to agriculture, food, and natural resource systems. Students completing a program of study in this pathway will demonstrate competence in principles and techniques for the development, application, and management of biotechnology in the context of AFNR.

Within each pathway, the standards are organized as follows:

- ***Standards***– These are the standards set forth by the National Council for Agricultural Education for Biotechnology Systems. They define what students should know and be able to do after completing instruction in a program of study focused on applying Biotechnology to AFNR systems.
- ***Performance Indicators*** – These statements distill each standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related standard at the conclusion of a program of study in this area.

BS.01. Assess factors that have influenced the evolution of biotechnology in agriculture (e.g., scientific technologies, historical events, societal trends, ethical and legal implications, etc.).

BS.01.01. Investigate and explain the relationships in the timeline of developing biotechnology applications and techniques in agriculture (e.g., major innovators, historical developments, potential applications of biotechnology, etc.).
BS.01.02. Evaluate the roles, scope, and implications of regulatory agencies on applications of biotechnology in agriculture and the protection of public interests (e.g., health, safety, environmental issues, etc.).

BS.01.03. Analyze the relationship and implications of bioethics, laws, and public perceptions on applications of biotechnology in agriculture (e.g., ethical, legal, social, cultural issues).

BS.02. Demonstrate proficiency by safely applying appropriate laboratory skills to complete tasks in a biotechnology research and development environment (e.g., standard operating procedures, record keeping, aseptic technique, equipment maintenance, etc.).

BS.02.01. Read, document, evaluate, and secure accurate laboratory records of experimental protocols, observations, and results.

BS.02.02. Identify and apply standard laboratory procedures and equipment maintenance to create and maintain reliable data BS.02.01. Read, document, evaluate, and secure accurate laboratory records of experimental protocols, observations, and results.

BS.02.03. Apply standard operating procedures for the safe handling of biological and chemical materials in a laboratory.

BS.02.04. Safely manage and dispose of biological materials, chemicals, and wastes according to standard operating procedures.

BS.02.05. Examine and perform scientific procedures using microbes, DNA, RNA and proteins in a laboratory.

BS.03. Demonstrate the application of biotechnology to solve problems in Agriculture, Food and Natural Resources (AFNR) systems (e.g., bioengineering, food processing, waste management, horticulture, forestry, livestock, crops, etc.).

BS.03.01. Apply biotechnology principles, techniques, and processes to modify a species.

BS.03.02. Apply biotechnology principles, techniques, and processes to enhance the production of food through the use of microorganisms and enzymes.

BS.03.03. Apply biotechnology principles, techniques, and processes to protect the environment and maximize use of natural resources (e.g., biomass, bioprospecting, industrial biotechnology, etc.).

BS.03.04. Apply biotechnology principles, techniques, and processes to enhance plant and animal care and production (e.g., selective breeding, pharmaceuticals, biodiversity, etc.).

BS.03.05. Apply biotechnology principles, techniques, and processes to produce bioproducts (e.g., fermentation, transesterification, methanogenesis, etc.).

BS.03.06. Apply biotechnology principles, techniques, and processes to improve waste management (e.g., genetically modified organisms, bioremediation, etc.).

Career Ready Practices Content Standards

Career Ready Practices (CRPs) encompass fundamental skills and practices that all students should acquire to be career ready such as: responsibility, productivity, healthy choices, maintaining personal finances, communication, decision-making, creativity and innovation, critical-thinking, problem-solving, integrity, ethical leadership, management, career planning, technology use and cultural/global competency. Students completing a program of study in any AFNR career pathway will demonstrate the knowledge, skills and behaviors that are important to career ready through experiences in a variety of settings (e.g., classroom, CTSO, work-based learning, community etc.).

Within each pathway, the standards are organized as follows:

- ***Standards*** – These are the standards owned by Advance CTE and used here with permission. The standards defined the scope and guided the development of the updated indicators and sample measurements.
- ***Performance Indicators*** – These statements distill each standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related standard at the conclusion of a program of study in this area.

CRP.01. Act as a responsible and contributing citizen and employee.

CRP.01.01. Model personal responsibility in the workplace and community.

CRP.01.02. Explain the short-term and long-term impacts of personal and professional decisions on employers and community before taking action.

CRP.01.03. Identify and act upon opportunities for professional and community service at the workplace.

CRP.02. Apply appropriate academic and technical skills.

- **CRP.02.01.** Use strategic thinking to connect and apply academic learning, technical knowledge, and skills to solve problems in the workplace and community.

CRP.03. Attend to personal health and financial well-being.

- **CRP.03.01.** Design and implement a personal wellness plan.
- **CRP.03.02.** Design and implement a personal financial management plan.

CRP.04. Communicate clearly, effectively and with reason.

- **CRP.04.01.** Communicate using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings.
- **CRP.04.02.** Produce clear, reasoned, and coherent written and visual communication in formal and informal settings.
- **CRP.04.03.** Model active listening strategies when interacting with others in formal and informal settings.

CRP.05. Consider the environmental, social and economic impacts of decisions.

- **CRP.05.01.** Assess, identify, and synthesize the information and resources needed to make decisions that positively impact the workplace and community.
- **CRP.05.02.** Make, defend, and evaluate decisions at work and in the community using information about the potential environmental, social, and economic impacts.

CRP.06. Demonstrate creativity and innovation.

- **CRP.06.01.** Synthesize information, knowledge, and experience to generate original ideas and challenge assumptions in the workplace and community.
- **CRP.06.02.** Assess a variety of workplace and community situations to identify ways to add value and improve the efficiency of processes and procedures.
- **CRP.06.03.** Create and execute a plan of action for new ideas and introduce innovations to workplace and community organizations.

CRP.07. Employ valid and reliable research strategies.

- **CRP.07.01.** Select and implement reliable research processes and methods to generate data for decision making in the workplace and community.
- **CRP.07.02.** Evaluate the validity of sources and data used when considering the adoption of new technologies, practices, and ideas in the workplace and community.

CRP.08. Utilize critical thinking to make sense of problems and persevere in solving them.

- **CRP.08.01.** Apply reason and logic to evaluate workplace and community situations from multiple perspectives.
- **CRP.08.02.** Investigate, prioritize and select solutions to solve problems in the workplace and community.
- **CRP.08.03.** Establish plans to solve workplace and community problems and execute them with resiliency.

CRP.09. Model integrity, ethical leadership and effective management.

- **CRP.09.01.** Model characteristics of ethical and effective leaders in the workplace and community (e.g. integrity, self-awareness, self-regulation, etc.).
- **CRP.09.02.** Implement personal management skills to function effectively and efficiently in the workplace (e.g., time management, planning, prioritizing, etc.).
- **CRP.09.03.** Demonstrate behaviors that contribute to a positive morale and culture in the workplace and community (e.g., positively influencing others, effectively communicating, etc.).

CRP.10. Plan education and career path aligned to personal goals.

- **CRP.10.01.** Identify career opportunities within a career cluster that match personal interests, talents, goals and preferences.
- **CRP.10.02.** Examine career advancement requirements (e.g., education, certification, training, etc.) and create goals for continuous growth in a chosen career.
- **CRP.10.03.** Develop relationships with and assimilate input and/or advice from experts (e.g., counselors, mentors, etc.) to plan career and personal goals in a chosen career area.
- **CRP.10.04.** Identify, prepare, update and improve the tools and skills necessary to pursue a chosen career path.

CRP.11. Use technology to enhance productivity.

CRP.11.01. Research, select and use new technologies, tools and applications to maximize productivity in the workplace and community.

CRP.11.02. Evaluate personal and organizational risks of technology use and take actions to prevent or minimize risks in the workplace and community.

CRP.01.03. Identify and act upon opportunities for professional and community service at the workplace.

CRP.12. Work productively in teams while using cultural/global competence.

CRP.12.01. Contribute to team-oriented projects and build consensus to accomplish results using cultural global competence in the workplace and community.

CRP.12.02. Create and implement strategies to engage team members to work toward team and organizational goals in a variety of workplace and community situations (e.g., meetings, presentations, etc.).

Education, Communication, and Leadership Career Pathway Content Standards

The Education, Communication, and Leadership (ECL) Career Pathway joins together three disciplines that focus on ways to best inform, educate and advance the agricultural industry. Students completing a program of study in this pathway will demonstrate an understanding of effective education, leadership, and strategic communication in AFNR settings.

Within each pathway, the standards are organized as follows:

- ***Standards***– These are the standards set forth by the National Council for Agricultural Education for Education, Communication, and Leadership. They define what students should know and be able to do after completing instruction in a program of study focused on applying Education, Communication, and Leadership to AFNR systems.
- ***Performance Indicators*** – These statements distill each standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related standard at the conclusion of a program of study in this area.

ECL.01. Develop a plan for an educational workshop or lesson - recognizing the breadth of opportunities in agricultural education - that informs, educates and promotes a topic or concept relevant to AFNR.

ECL.01.01. Explore the breadth of opportunities in agricultural education (e.g., using state or national resources, Teach Ag, university program information, professional associations, etc.).

ECL.01.02. Apply fundamental understanding of AFNR and agricultural education - including experiential learning - to the development of a workshop or lesson.

ECL.02. Apply curriculum development and effective instructional techniques to create, teach and evaluate an agricultural education lesson.

ECL.02.01. Develop and deliver a workshop or lesson using a variety of methods and best practices in instruction and facilitation.

ECL.02.02. Evaluate facilitation or presentation strategies that encourage appropriate social interactions, embrace diversity, promote equity and build a positive learning environment that is welcoming to all individuals.

ECL.02.03. Demonstrate impactful leadership as a credible resource for AFNR.

ECL.03. Evaluate the effectiveness of various communication strategies with related methods and platforms used by organizations across AFNR industries.

ECL.03.01. Identify the methods and characteristics of effective verbal, nonverbal, written, and visual communication.

ECL.03.02. Analyze the use of verbal, nonverbal, written, and visual communication platforms in AFNR.

ECL.03.03. Analyze similarities and differences between verbal, nonverbal, written, and visual communication methods.

ECL.04. Develop a written communication plan using various communication methods (e.g. news releases, social media, speaking opportunities, blogs, podcasts, etc.) to convey a message to an intended AFNR audience.

ECL.04.01. Develop a communications plan that includes purpose, target audience, message, medium, and outcome evaluation.

ECL.04.02. Identify, apply and demonstrate communication skills and methods per the communications plan.

ECL.05. Model characteristics of ethical, efficient, and effective leaders in the workplace and community (e.g. integrity, collaboration, self-awareness, self-regulation, etc.).

ECL.05.01. Identify characteristics and behaviors that constitute ethical, efficient, and effective leadership.

ECL.05.02. Demonstrate leadership through advocacy for AFNR-related issues.

Environmental Sustainability Systems
Career Pathway Content Standards

The Environmental Service Systems (ESS) Career Pathway encompasses the study of systems, instruments and technology, and sustainable practices used to monitor and minimize the impact of human activity on environmental systems in the supply chain. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the development, application and management of environmental service systems in AFNR settings.

Within each pathway, the standards are organized as follows:

- ***Standards***– These are the standards owned by Advance CTE and used here with permission. The standards defined the scope and guided the development of the updated indicators and sample measurements.
- ***Performance Indicators*** – These statements distill each standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related standard at the conclusion of a program of study in this area.

ESS.01. Use analytical procedures and instruments to manage environmental service systems.

ESS.01.01. Analyze and interpret laboratory and field samples in environmental sustainability systems.

ESS.01.02. Properly utilize scientific instruments in environmental monitoring situations (e.g., laboratory equipment, environmental monitoring instruments, etc.).

ESS.02. Evaluate the impact of public policies and regulations on environmental service system operations.

ESS.02.01. Interpret and evaluate the impact of laws, agencies, policies, practices, and consumer preferences affecting environmental service systems.

ESS.02.02. Compare and contrast the impact of current trends on regulation of environmental sustainability systems.

ESS.02.03. Examine and summarize the impact of public perceptions and social movements on the regulation of environmental sustainability systems.

ESS.03. Develop proposed solutions to environmental issues, problems and applications using scientific principles of meteorology, soil science, hydrology, microbiology, chemistry and ecology.

ESS.03.01. Apply meteorology principles to environmental sustainability systems.

ESS.03.02. Apply soil science and hydrology principles to environmental sustainability systems.

ESS.03.03. Apply chemistry principles to environmental sustainability systems.

ESS.03.04. Apply microbiology principles to environmental sustainability systems.

ESS.03.05. Apply ecology principles to environmental sustainability systems.

ESS.04. Demonstrate the operation of environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management and energy conservation).

ESS.04.01. Develop systems of sustainability management for all categories of solid waste in environmental sustainability systems.

ESS.04.02. Sustainably manage solid waste in environmental service systems.

ESS.04.03. Apply techniques to ensure a safe supply of drinking water and adequate treatment of wastewater according to applicable rules and regulations.

ESS.04.04. Compare and contrast the impact of conventional and alternative energy sources on the environment and operation of environmental sustainability systems.

ESS.05. Use tools, equipment, machinery and technology common to tasks in environmental service systems.

ESS.05.01. Use technological and mathematical tools to map land, facilities, and infrastructure for environmental sustainability systems.

ESS.05.02. Perform assessments of environmental conditions using equipment, machinery, and technology.

Food Products and Processing Systems
Career Pathway Content Standards

The Food Products and Processing Systems (FPP) Career Pathway encompasses the study of food safety, sanitation, nutrition, biology, microbiology, chemistry, human behavior in local and global food systems, food selection, processing for storage, distribution and consumption, and the historical and current development of the food industry. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the development, application, and management of food products and processing systems in AFNR settings.

Within each pathway, the standards are organized as follows:

- ***Standards***– These are the standards owned by Advance CTE and used here with permission. The standards defined the scope and guided the development of the updated indicators and sample measurements.
- ***Performance Indicators*** – These statements distill each standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related standard at the conclusion of a program of study in this area.

FPP.01. Develop and implement procedures to ensure safety, sanitation and quality in food products and processing facilities.

FPP.01.01. Distinguish between various food safety programs and management systems in food products and processing facilities.

FPP 01.02. Apply food safety and quality assurance procedures in the harvesting, handling and processing of food products.

FPP.01.03. Apply food safety procedures during storage and distribution to ensure food quality.

FPP.02. Apply principles of nutrition, biology, microbiology, chemistry and human behavior to the development of food products.

FPP.02.01. Apply principles of nutrition and biology to develop food products that provide a safe, wholesome, and nutritious food supply for local and global food systems.

FPP.02.02. Apply principles of microbiology and chemistry to develop food products to provide a safe, wholesome, and nutritious food supply for local and global food systems.

FPP.02.03. Apply principles of human behavior to develop food products to provide a safe, wholesome, and nutritious food supply for local and global food systems.

FPP.03. Select and process food products for storage, distribution and consumption.

FPP.03.01. Implement selection, evaluation, and inspection techniques to ensure safe and quality food products.

FPP.03.02. Design and apply techniques of food processing, preservation, packaging, and presentation for distribution and consumption of food products.

FPP.03.03. Create food distribution plans and procedures to ensure safe delivery of food products.

FPP.04. Explain the scope of the food industry and the historical and current developments of food products and processing.

FPP.04.01. Examine the scope of the food industry by evaluating local and global policies, trends, and customs for food production.

FPP.04.02. Evaluate the significance and implications of changes and trends in the food products and processing industry in the local and global food systems.

FPP.04.03. Identify the purpose of industry organizations, groups, and regulatory agencies that influence the local and global food systems.

FPP.04.04. Evaluate the effectiveness of current sustainability practices in their role to food products and processing.

Foundational Pathway Skills
Content Standards

The Agriculture, Food, and Natural Resources (AFNR) Foundational Pathway Skills (FPS) encompasses the study of essential knowledge and skills related to all AFNR professions. Students completing a program of study in any AFNR career pathway will demonstrate fundamental knowledge of the nature, scope and relationships of AFNR systems and the skills necessary for analysis of current and historical issues and trends; application of technologies; safety, health, and environmental practices; stewardship of natural resources; and exploration of career opportunities.

Within each pathway, the standards are organized as follows:

- ***Standards 1-6*** – These are the standards owned by Advance CTE and used here with permission. The standards defined the scope and guided the development of the updated indicators and sample measurements.
- ***Standards 7-14*** – These are the standards set forth by the National Council for Agricultural Education for Foundational Pathway Skills. They define what students should know and be able to do after completing instruction in a program of study focused on applying Foundational Pathway Skills to AFNR systems.
- ***Performance Indicators*** – These statements distill each standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related standard at the conclusion of a program of study in this area.

FPS.01. Analyze how issues, trends, technologies and public policies impact systems in the Agriculture, Food & Natural Resources Career Cluster.

FPS.01.01. Research, examine, and discuss issues and trends that impact AFNR systems on local, state, national, and global levels.
FPS.01.02. Examine technologies and analyze their impact on AFNR systems.
FPS.01.03. Identify public policies and examine their impact on AFNR systems.

FPS.02. Evaluate the nature and scope of the Agriculture, Food & Natural Resources Career Cluster and the role of agriculture, food and natural resources (AFNR) in society and the economy.

FPS.02.01. Research and use geographic and economic data to solve problems in AFNR systems.
FPS.02.02. Examine the impact of AFNR on the local, state, national, and global society and economy.

FPS.03. Examine and summarize the importance of health, safety and environmental management systems in AFNR workplaces.

FPS.03.01. Identify and explain the implications of required regulations to maintain and improve safety, health, and environmental management systems.
FPS.03.02. Develop and implement a plan to maintain and improve health, safety, and environmental compliance and performance.
FPS.03.03. Apply health and safety practices to AFNR workplaces.
FPS.03.04. Use appropriate protective equipment and demonstrate safe and proper use of AFNR tools and equipment.

FPS.04. Demonstrate stewardship of natural resources in AFNR activities.

FPS.04.01. Identify and implement practices to steward natural resources in different AFNR systems.
FPS.04.02. Assess and explain the natural resource related trends, technologies and policies that impact AFNR systems.

FPS.05. Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources career pathways.

FPS.05.01. Evaluate and implement the steps and requirements to pursue a career opportunity in each of the AFNR career pathways (e.g., goals, degrees, certifications, resumes, cover letter, portfolios, interviews, etc.).
FPS.05.02. Examine and choose career opportunities that are matched to personal skills, talents, and career goals in an AFNR pathway of interest.

FPS.06. Analyze the interaction among AFNR systems in the production, processing and management of food, fiber and fuel and the sustainable use of natural resources.

FPS.06.01. Examine and explain foundational cycles and systems of AFNR.

FPS.07. Recognize the value of a Supervised Agricultural Experience (SAE) as Work-Based Learning.

FPS.07.01. Evaluate the value of an SAE.
FPS.07.02. Connect SAE involvement to lifelong learning and career skills.
FPS.07.03. Define and summarize the foundational and immersion SAEs and the relationship between the two.

FPS.08. Utilize critical thinking to make sense of problems and persevere in solving them.

FPS.08.01. Explore career opportunities and create a plan to prepare for a chosen career.
FPS.08.02. Develop employability skills needed to be successful in a chosen career field.
FPS.08.03. Engage in personal financial practices that lead to financial independence.
FPS.08.04. Assess the importance of health and safety in the AFNR workplace.
FPS.08.05. Evaluate the nature and role that agriculture plays in society, the environment, and the economy.

FPS.09. Recognize the options within and participate in immersive supervised agricultural experiences.
FPS.09.01. Develop AFNR technical knowledge and skills through a personal immersion SAE.
FPS.09.02. Engage in record-keeping practices that promote financial literacy.

FPS.10. Analyze the history of the National FFA Organization and how this timeline has allowed the organization to remain relevant.
FPS.10.01. Evaluate the importance of key events within the organization's history.

FPS.11. Evaluate the structure and value of agricultural education.
FPS.11.01. Interpret the interaction of the three components of agricultural education.
FPS.11.02. Summarize the importance of classroom instruction within agricultural education.
FPS.11.03. Summarize the importance of the National FFA Organization within agricultural education.
FPS.11.04. Summarize the importance of Supervised Agricultural Experiences (SAE) within agricultural education.

FPS.12. Examine the key components providing directional leadership to the National FFA Organization.
FPS.12.01. Identify the importance of the FFA Creed.
FPS.12.02. Identify the importance of the FFA Emblem.
FPS.12.03. Identify the importance of the FFA Mission statement.
FPS.12.04. Identify the importance of a Program of Activities.

FPS.13. Analyze the structures and procedures to effectively and professionally run and manage a meeting.
FPS.13.01. Utilize parliamentary resources to solve problems of organizational management and operations.
FPS.13.02. Present a logical, realistic, and convincing debate on motions.
FPS.13.03. Evaluate agendas, minutes, the constitution, bylaws, and other organizational documents.

FPS.14. Evaluate opportunities to develop leadership, citizenship, and career skills.
FPS.14.01. Evaluate the importance and value of leadership skills.
FPS.14.02. Evaluate the importance and value of citizenship skills.
FPS.14.03. Evaluate the importance and value of career skills.
FPS.14.04. Connect opportunities in leadership, citizenship, and career skills to student development.

Natural Resource Systems
Career Pathway Content Standards

The Natural Resource Systems (NRS) Career Pathway encompasses the study of the management, protection, enhancement and improvement of soil, water, wildlife, forests, and air as natural resources. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the development, application, and management of natural resource systems in AFNR settings.

Within each pathway, the standards are organized as follows:

- ***Standards***– These are the standards owned by Advance CTE and used here with permission. The standards defined the scope and guided the development of the updated indicators and sample measurements.
- ***Performance Indicators*** – These statements distill each standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related standard at the conclusion of a program of study in this area.

NRS.01. Plan and conduct natural resource management activities that apply logical, reasoned and scientifically based solutions to natural resource issues and goals.
NRS.01.01. Examine natural resource availability and ecosystem function in a particular region.
NRS.01.02. Classify different types of natural resources in order to enable protection, conservation, enhancement, and management in a particular geographical region.
NRS.01.03. Apply ecological concepts and principles (e.g., weather, air quality, UV protection, atmospheric pressure, etc.) to the interaction of atmospheric and natural resource systems.
NRS.01.04. Apply ecological concepts and principles to aquatic natural resource systems.
NRS.01.05. Apply ecological concepts and principles to terrestrial natural resource systems.
NRS.01.06. Apply ecological concepts and principles to biotic organisms in natural resource systems.

NRS.02.01. Analyze the interrelationships between natural resources and humans.

NRS.02.01. Examine and interpret the purpose, enforcement, impact, and effectiveness of laws, agencies, and private and public organizations related to natural resource management, protection, enhancement, and improvement (e.g., water regulations, game laws, environmental policy, local, state, and national conservation organizations, agricultural extension service, etc.).

NRS.02.02. Assess the impact of human activities on the availability of natural resources.

NRS.02.03. Analyze how social perceptions of natural resource management, protection, enhancement, and improvement change and develop over time.

NRS.02.04. Examine and explain how economics affects the use of natural resources.

NRS.02.05. Communicate information to the public regarding topics related to the management, protection, enhancement, and improvement of natural resources.

NRS.03. Develop plans to ensure sustainable production and processing of natural resources.

NRS.03.01. Sustainably produce, harvest, process, and use natural resource products (e.g., forest and rangeland products, wildlife, minerals, fossil fuels, shale oil, alternative energy, recreation, aquatic species, etc.).

NRS.03.02. Demonstrate cartographic skills, tools, and technologies to aid in developing, implementing and evaluating natural resource management plans.

NRS.04. Demonstrate responsible management procedures and techniques to protect, maintain, enhance, and improve natural resources.

NRS.04.01. Demonstrate natural resource protection, maintenance, enhancement, and improvement techniques.

NRS.04.02. Diagnose plant and wildlife diseases and follow protocols to prevent their spread.

NRS.04.03. Prevent or manage introduction of ecologically harmful species in a particular region.

NRS.04.04. Manage fires in natural resource systems.

Plant Systems
Career Pathway Content Standards

The Plant Systems (PS) Career Pathway encompasses the study of plant life cycles, classifications, functions, plant structures, greenhouse and nursery structures, field conditions, reproduction, media and nutrients, as well as growth and cultural practices through the study of crops, turf grass, trees, shrubs and/or ornamental plants. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the development, application and management of plant systems in AFNR settings.

Within each pathway, the standards are organized as follows:

- ***Standards***– These are the standards owned by Advance CTE and used here with permission. The standards defined the scope and guided the development of the updated indicators and sample measurements.
- ***Performance Indicators*** – These statements distill each standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related standard at the conclusion of a program of study in this area.

PS.01. Develop and implement a crop management plan for a given production goal that accounts for environmental factors.

PS.01.01. Determine the influence of environmental factors on plant growth.

PS.01.02. Prepare and adjust growing media for use in plant systems.

PS.01.03. Demonstrate planting techniques and create the conditions needed for seed germination.

PS.01.04. Develop and implement a nutrient management and/or fertilizer plan for specific plants or crops.

PS.02. Apply principles of classification, plant anatomy, and plant physiology to plant production and management.

PS.02.01. Classify plants according to taxonomic systems.

PST.02.02. Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.

PS.02.03. Apply knowledge of plant physiology and energy conversion to plant systems.

PS.03. Propagate, culture and harvest plants and plant products based on current industry standards.

PS.03.01. Demonstrate plant propagation techniques in plant system activities.

PS.03.02. Develop and implement a management plan for plant production.
PS.03.03. Develop and implement a plan for integrated pest management for plant production.
PS.03.04. Apply principles and practices of sustainable agriculture to plant production.
PS.03.05. Harvest crops according to industry standards.
PS.03.06. Haul and store crops according to industry standards.

PS.04. Apply principles of design in plant systems to enhance an environment (e.g. floral, forest landscape, and farm).
PS.04.01. Evaluate, identify, and prepare plants to enhance an environment.
PS.04.02. Create designs using plants.

Power, Structural, and Technical Systems Career Pathway Content Standards

The Power, Structural and Technical Systems (PST) Career Pathway encompasses the study of agricultural equipment, power systems, sustainable fuel sources and precision technology, as well as woodworking, metalworking, welding, electrification, and project planning for agricultural structures. Students completing a program of study in this pathway will demonstrate competence in the application of principles and techniques for the development, application and management of power, structural and technical systems in AFNR settings.

Within each pathway, the standards are organized as follows:

- ***Standards***– These are the standards owned by Advance CTE and used here with permission. The standards defined the scope and guided the development of the updated indicators and sample measurements.
- ***Performance Indicators*** – These statements distill each standard into more discrete indicators of the knowledge and skills students should attain through a program of study in this pathway. Attainment of the knowledge and skills outlined in the performance indicators is intended to demonstrate an acceptable level of proficiency with the related standard at the conclusion of a program of study in this area.

PST.01. Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.
PST.01.01. Apply physical science and engineering principles to assess and select energy sources for AFNR power, structural, and technical systems.
PST.01.02. Apply physical science and engineering principles to design, implement and improve safe and efficient mechanical systems in AFNR situations.
PST.01.03. Apply physical science and engineering principles to metal fabrication using a variety of welding and cutting processes and equipment (e.g., SMAW, GMAW, GTAW, Oxy-fuel, CNC, and plasma arc torch, etc.).

PST.02. Operate and maintain AFNR mechanical equipment and power systems.
PST.02.01. Perform preventative maintenance and scheduled service to maintain equipment, machinery, and power units used in AFNR settings.
PST.02.02. Operate machinery and equipment while observing all safety precautions in AFNR settings.

PST.03. Service and repair AFNR mechanical equipment and power systems.
PST.03.01. Troubleshoot, service, and repair components of internal combustion engines using manufacturers' guidelines.
PST.03.02. Service electrical systems and components of mechanical equipment and power systems using a variety of troubleshooting and/or diagnostic methods.
PST.03.03. Utilize manufacturers' guidelines to diagnose and troubleshoot malfunctions in machinery, equipment, and power source systems (e.g., hydraulic, pneumatic, transmission, steering, powertrain, suspension, etc.).

PST.04. Plan, build and maintain AFNR structures.
PST.04.01. Create plans for AFNR structures.
PST.04.02. Determine structural requirements, specifications, customer needs, and estimate costs for AFNR structures.
PST.04.03. Apply best practices and safety guidelines for use of hand and power tools associated with constructing and maintaining AFNR structures.
PST.04.04. Follow architectural and mechanical plans to construct, maintain and/or repair AFNR structures (e.g., material selection, site preparation and/or layout, surveying, electrical, plumbing, concrete/masonry, etc.).
PST.04.05. Apply electrical wiring principles in AFNR structures.

PST.05. Use control, monitoring, geospatial and other technologies in AFNR power, structural, and technical systems.

PST.05.01. Apply current and/or identify emerging technologies (e.g., robotics, CNC, UAS, etc.) to solve problems and increase the efficiency of AFNR systems.

PST.05.02. Prepare and/or use electrical drawings to design, install, and troubleshoot electronic control systems in AFNR settings.

PST.05.03. Apply geospatial principles and technologies to solve problems and increase the efficiency of AFNR systems.

Mississippi College- and Career-Readiness Standards (MS CCRS)
Algebra I

	Units								
Standards	1	2	3	4	5	6	7	8	9
N-RN.3			X					X	
N-Q.1			X			X	X	X	X
N-Q.2			X			X	X		X
N-Q.3			X					X	X
A-SSE.1			X			X	X		
A-SSE.2			X			X	X		
A-SSE.3			X				X		
A-APR.1			X						
A-APR.3									
A-CED.1			X				X		X
A-CED.2			X				X		
A-CED.3			X				X		
A-CED.4			X				X		
A-REI.1			X				X		
A-REI.3			X				X		
A-REI.4			X						
A-REI.5									
A-REI.6									
A-REI.10			X				X		
A-REI.11									
A-REI.12									

	Units								
Standards	1	2	3	4	5	6	7	8	9
F-IF.1			X				X		
F-IF.2			X				X		
F-IF.3			X						
F-IF.5			X				X		
F-IF.6			X						
F-IF.7			X						
F-IF.8			X						
F-IF.9									
F-BF.1									
F-BF.3			X						
F-LE.1									
F-LE.2			X						
F-LE.5			X						
S-ID.1			X						
S-ID.2			X				X		
S-ID.3			X				X		
S-ID.5			X				X		
S-ID.6			X						
S-ID.7			X						
S-ID.8			X				X		
S-ID.9									

Number and Quantity

The Real Number System (N-RN)

N-RN.3 Explain why the sum or product of two rational numbers is rational; the sum of a rational number and an irrational number is irrational; and the product of a nonzero rational number and an irrational number is irrational.

Quantities (N-Q)

N-Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

N-Q.2 Define appropriate quantities for the purpose of descriptive modeling.

N-Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Algebra

Seeing Structure in Expressions (A-SSE)

A-SSE.1 Interpret expressions that represent a quantity in terms of its context.
A-SSE.2 Use the structure of an expression to identify ways to rewrite it.
A-SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

Arithmetic with Polynomials and Rational Expressions (A-APR)

A-APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
A-APR.3 Identify zeros of polynomials when suitable factorizations are available and use the zeros to construct a rough graph of the function defined by the polynomial (limit to 1st- and 2nd-degree polynomials).

Creating Equations (A-CED)

A-CED.1 Create equations and inequalities in one variable and use them to solve problems.
A-CED.2 Create equations in two variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
A-CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.
A-CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

Reasoning with Equations and Inequalities (A-REI)

A-REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
A-REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
A-REI.4 Solve quadratic equations in one variable.
A-REI.5 Given a system of two equations in two variables, show and explain why the sum of equivalent forms of the equations produces the same solution as the original system.
A-REI.6 Solve systems of linear equations algebraically, exactly, and graphically while focusing on pairs of linear equations in two variables.
A-REI.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
A-REI.11 Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, quadratic, absolute value, and exponential functions.
A-REI.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Functions

Interpreting Functions (F-IF)

F-IF.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).
F-IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
F-IF.3 Recognize that sequences are functions whose domain is a subset of the integers.
F-IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
F-IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
F-IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

F-IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions.)

Building Functions (F-BF)

F-BF.1 Write a function that describes a relationship between two quantities.

F-BF.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs.

Linear, Quadratic, and Exponential Models (F-LE)

F-LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.

F-LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

F-LE.5 Interpret the parameters in a linear or exponential function in terms of a context.

Functions Statistics and Probability

Interpreting Categorical and Quantitative Data (S-ID)

S-ID.1 Represent and analyze data with plots on the real number line (dot plots, histograms, and box plots).

S-ID.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

S-ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

S-ID.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

S-ID.6 Represent data on two quantitative variables on a scatter plot and describe how the variables are related.

S-ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

S-ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.

S-ID.9 Distinguish between correlation and causation.

FFA Career and Leadership Development Events Alignment

Agricultural Technology and Mechanical Systems		
Unit	**Competency/Objective**	**CDE/LDE Alignment**
Unit 1: Leadership and SAE for All	1. Participate in local, state, and/or national FFA activities that provide opportunities for leadership development and career exploration. 1a. Actively participate in FFA activities.	Entire Event
Unit 2: Safety	1a. Describe personal safety rules for working in the laboratory and/or agricultural mechanics industry. 1b. Describe general workplace safety rules per safety organizations standards. 1c. Identify standard industry safety color code scheme. 2. Investigate Occupational Safety and Health Administration (OSHA) regulations and complete certification if applicable. 3. Identify hazardous materials that may be found in the laboratory or on a job site and describe procedures for handling/avoidance or removal of materials. 3a. Explain the purpose and use of Safety Data Sheets (SDS). 3b. Review an SDS form to identify safe handling and disposal procedures for hazardous materials. 4. Demonstrate the selection and use of hand tools in agricultural mechanics.	Individual Activities (Machinery and Equipment Practicum; Structures Practicum; Written Examination)
Unit 3: Introduction to Agricultural Mechanization	1. Investigate the role of mechanical technology in agriculture. 2. Apply math skills related to the industry. 3. Read and interpret technical plans for constructing a simple project.	Individual Activities (Machinery and Equipment Practicum; Written Examination)
Unit 4: Oxyfuel and Plasma-Cutting Operations	1. Explain procedures for applying fire safety with cutting operations. 3. Assemble and handle oxyfuel cutting equipment. 5. Describe and demonstrate principles of plasma-cutting procedures.	Individual Activities (Machinery and Equipment Practicum)
Unit 5: Principles of Welding	1. Describe basic equipment, operations, and procedures, including safety precautions, of arc welding. 1c. List the major types of welding used in agricultural equipment repair and fabrication and discuss their characteristics and applications. 2. Perform welding techniques using SMAW and metal inert gas MIG. 2a. Demonstrate the procedure for striking an arc and running a flat bead. 2b. Demonstrate procedures to construct a butt weld in the following positions. 2c. Demonstrate procedures to construct a fillet weld in the following positions.	Individual Activities (Machinery and Equipment Practicum)
Unit 6: Hydraulic and Pneumatic Systems in Agriculture	1a. Identify major components and the purpose and function of hydraulic and pneumatic systems. 1c. Compare and contrast the operation of a pneumatic system to the operation of a hydraulic system.	Individual Activities (Compact Equipment Practicum)

	1d. Demonstrate the operation of a pneumatic system to perform work. 1e. Demonstrate the operation of a hydraulic system to perform work.	
Unit 7: Electrical Systems Applications in Agriculture	1a. Identify common symbols, schematics, and drawings of electrical systems. 1b. Measure resistance, voltage, and current in a circuit using multimeter. 1c. Calculate resistance, voltage, and current in a circuit using Ohm's law. 3. Perform AC wiring techniques.	Individual Activities (Electricity Practicum)
Unit 8: Principles of Engines	1c. Compare and contrast the operating principles of four- and two-stroke gasoline engines. 3. Disassemble, inspect, and reassemble a small gasoline engine. 3a. Disassemble a small gasoline engine, including removing the head, oil pan, piston and crankshaft assembly, and valves. 3b. Inspect and measure parts of the engine to verify it is within the tolerances set by the manufacturer. 3c. Reassemble the engine and test for proper operation.	Individual Activities (Compact Equipment Practicum)
Unit 9: Service, Management, and Operation of Agricultural Equipment	2b. Demonstrate the procedures for pre-inspection and start-up of an internal combustion engine. 3. Demonstrate recommended maintenance practices for agricultural equipment. 3c. Perform maintenance routines. 3d. Complete a work order for a given repair or maintenance procedure and calculate the cost of the repair.	Individual Activities (Machinery and Equipment Practicum; Compact Equipment Practicum)