North Dakota Agriculture Education

Content Standards

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Adapted from Common Career and Technical Core, Career Cluster™, www.careertech.org; and the 2015 AFNR standards from National FFA, www.ffa.org.

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The final standards document has been approved by the State ND FFA Teacher Board of Directors.

Career and Technical Education Standards Introduction

Mission

The mission of the State Board for Career and Technical Education (CTE) is to work with others to provide all North Dakota citizens with the technical skills, knowledge, and attitudes necessary for successful performance in a globally competitive workplace.

Vision

The State Board for Career and Technical Education (CTE) is committed to providing career awareness, work readiness skills, occupational preparation, and retraining of workers throughout the state. Career and technical education will span all educational levels, providing youth with exploration opportunities and the foundation skills needed to enter the world of work while providing adults with skills needed to enter, re-enter, or advance in the workforce.

Goal

North Dakota Career and Technical Education's goal is to create a competitive and knowledgeable work force. This is accomplished through a variety of educational program areas that are organized to prepare students for careers in their chosen fields, to take leadership roles, and balance their multiple roles in life. CTE programs prepare students with the knowledge and skills to make informed career choices, to integrate and apply academic concepts, to prepare for successful participation in a global society, and to engage in lifelong learning.

Standards Development Process

Standards development is a multi-phase process. Existing and/or industry standards are the basis for the North Dakota Program Standards. A team of expert secondary and postsecondary teachers, business and industry representatives, and the state program supervisor draft the standards document. Once the document is finalized, the State Board for Career and Technical Education approves and adopts the standards.

Course Frameworks are also developed by the writing team. A framework includes a brief overview of the course content, topical units of study, and identifies the standards recommended for inclusion within the course. The frameworks are tailored to prepare young people for the opportunities in North Dakota. School Districts will use the frameworks as a guide for developing curriculum that reflects local needs.

Key Principles of Career and Technical Education

We believe that Career Technical Education:

1. **Draws its curricula, standards, and organizing principles from the workplace.**
   The workplace provides the context, objectives, and organizing constructs for instruction and assessment. The workplace also defines the standards of performance necessary, including those required for academic, technical, and employability skills.

2. **Is a critical and integral component of the total educational system, offering career-oriented benefits for all students.**
   CTE classes offer educational benefits to students pursuing careers requiring specific technical skills as well as providing a strong foundation for those pursuing a traditional four-year (or more) degree.

3. **Is a critical and integral component of the workforce development system, providing the essential foundation for a thriving economy.**
   Preparation of a well-prepared, qualified workforce requires solid academics, good work ethics, and specific technical skills as well as the ability to communicate, work with others, solve problems, and use information. CTE contributes directly to this preparation by providing a curriculum tied to specific workplace requirements.

4. **Maintains high levels of excellence supported through identification of academic and workplace standards, measurement of performance (accountability), and high expectations for participant success.**
   Career Technical Education is committed to continuous improvement, attention to industry certification, and the development of highly qualified teachers.

5. **Is robust and flexible enough to respond to the needs of the multiple educational environments, customers, and levels of specialization.**
   CTE involves a large and complex delivery system that (1) integrates career exploration, (2) provides effective tools for organizing all curricula, (3) facilitates the teaching and use of technology, (4) is integrated into the total learning experience, (5) enhances the learning of academic subjects, (6) teaches broad occupational skills, (7) includes all aspects of the industry, (8) teaches how to balance family and work responsibilities, (9) provides job-specific training, (10) is offered at multiple levels of the educational continuum, and (11) is delivered through a variety of educational environments.

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Standard 1	AGRICULTURE, FOOD, & NATURAL RESOURCES (AFNR) CLUSTER SKILLS		
Topic 1.1	***Analyze how issues, trends, technologies, and public policies impact systems in the Agriculture, Food, & Natural Resources Career Cluster.***		
	Student Competencies		
	1.1.1	**RESEARCH, EXAMINE, AND DISCUSS ISSUES AND TRENDS THAT IMPACT AFNR SYSTEMS ON LOCAL, STATE, NATIONAL, AND GLOBAL LEVELS.**	
		1.1.1.1	Examine historical and current data to identify issues impacting AFNR systems.
		1.1.1.2	Research and summarize trends impacting AFNR systems.
		1.1.1.3	Analyze and summarize AFNR issues and their impact on local, state, national, and global levels.
		1.1.1.4	Analyze current trends in AFNR systems and predict their impact on local, state, national, and global levels.
		1.1.1.5	Evaluate and explain AFNR issues and their impacts to audiences with limited AFNR knowledge.
		1.1.1.6	Evaluate and explain emerging trends and the opportunities they may create within the AFNR systems.
	1.1.2	**EXAMINE TECHNOLOGIES AND ANALYZE THEIR IMPACT ON AFNR SYSTEMS.**	
		1.1.2.1	Research technologies used in AFNR systems.
		1.1.2.2	Compare and contrast AFNR systems before and after the integration of technology.
		1.1.2.3	Apply appropriate use of technologies in AFNR workplace scenarios.
		1.1.2.4	Analyze how technology is used in AFNR systems to maximize productivity.
		1.1.2.5	Solve problems in AFNR workplaces or scenarios using technology.
		1.1.2.6	Evaluate the importance of technology use and how it impacts AFNR systems.
	1.1.3	**IDENTIFY PUBLIC POLICIES AND EXAMINE THEIR IMPACT ON AFNR SYSTEMS.**	
		1.1.3.1	Summarize public policies affecting AFNR systems.
		1.1.3.2	Identify influential historical and current public policies that impact AFNR systems.
		1.1.3.3	Analyze and assess at least two public policies that impact each AFNR system.
		1.1.3.4	Create and propose a hypothetical policy that will impact current AFNR systems.
		1.1.3.5	Evaluate a public policy within AFNR systems and defend or challenge it.
		1.1.3.6	Create a plan for implementing a new public policy that will positively impact AFNR systems.
Topic 1.2	***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.***		
	Student Competencies		
	1.2.1	**RESEARCH AND USE GEOGRAPHIC AND ECONOMIC DATA TO SOLVE PROBLEMS IN AFNR SYSTEMS.**	
		1.2.1.1	Research and describe different types of geographic data used in AFNR systems.

		1.2.1.2	Identify and examine economic data related to AFNR systems (e.g., commodity markets, food marketing, food, and nutritional assistance programs, etc.).
		1.2.1.3	Analyze and interpret AFNR related geographic data using a variety of systems and technologies (e.g., GIS, GPS, etc.).
		1.2.1.4	Analyze and interpret a set of economic data and explain how it impacts an AFNR system.
		1.2.1.5	Evaluate geographic data and select necessary data sets to solve problems within AFNR systems.
		1.2.1.6	Devise a strategy to solve a problem in an AFNR system using a set of economic data.
	1.2.2	**EXAMINE THE COMPONENTS OF THE AFNR SYSTEMS AND ASSESS THEIR IMPACT ON THE LOCAL, STATE, NATIONAL, AND GLOBAL SOCIETY AND ECONOMY.**	
		1.2.2.1	Identify and summarize the components within AFNR systems (e.g., Animal Systems: health, nutrition, genetics, etc.; Natural Resources Systems: soil, water, etc.).
		1.2.2.2	Define and summarize societies on local, state, national, and global levels and describe how they relate to AFNR systems.
		1.2.2.3	Examine and summarize the components of the agricultural economy (e.g., environmental, crops, livestock, etc.).
		1.2.2.4	Assess components within AFNR systems and analyze relationships between systems.
		1.2.2.5	Assess how people within societies on local, state, national, and global levels interact with AFNR systems on daily, monthly, or yearly basis.
		1.2.2.6	Assess the economic impact of an AFNR system on a local, state, national, and global level.
		1.2.2.7	Devise and implement a strategy for explaining components of AFNR systems to audiences with limited knowledge.
		1.2.2.8	Evaluate how society traditions, customs, or policies have resulted from practices with AFNR systems.
		1.2.2.9	Evaluate how positive or negative changes in the local, state, national, or global economy impacts AFNR systems.
Topic 1.3	***Examine and summarize the importance of health, safety, and environmental management systems in AFNR workplaces.***		
	Student Competencies		
	1.3.1	**IDENTIFY AND EXPLAIN THE IMPLICATIONS OF REQUIRED REGULATIONS TO MAINTAIN AND IMPROVE SAFETY, HEALTH, AND ENVIRONMENTAL MANAGEMENT SYSTEMS.**	
		1.3.1.1	Research and explain the implications of regulatory, safety, and health standards on AFNR systems (e.g., SDS, bioterrorism, etc.)
		1.3.1.2	Summarize the importance of safety, health, and environmental management in the workplace.
		1.3.1.3	Execute health, safety, and environmental procedures to comply with regulatory and safety standards.
		1.3.1.4	Analyze existing required regulations within an AFNR workplace.

	1.3.1.5	Evaluate how AFNR organizations/businesses promote improved health, safety, and environmental management and determine steps to maintain compliance with regulatory and safety standards in AFNR situations.
	1.3.1.6	Construct and implement methods to evaluate compliance with required safety, health, and environmental management regulations.
1.3.2	**DEVELOP AND IMPLEMENT A PLAN TO MAINTAIN AND IMPROVE HEALTH, SAFETY, AND ENVIRONMENTAL COMPLIANCE AND PERFORMANCE.**	
	1.3.2.1	Research and identify components required in health and safety performance plans.
	1.3.2.2	Examine and categorize examples of environmental compliance plans from AFNR workplace.
	1.3.2.3	Analyze the effectiveness of health and safety performance plans of an AFNR workplace.
	1.3.2.4	Develop plans to improve environmental compliance and performance within an AFNR system.
	1.3.2.5	Create and implement a plan to improve safety, health, and environmental management regulations in an AFNR workplace.
	1.3.2.6	Devise and implement a strategy to educate employees on environmental compliance and performance in an AFNR workplace.
1.3.3	**APPLY HEALTH AND SAFETY PRACTICES TO AFNR WORKPLACES.**	
	1.3.3.1	Research and summarize the purposes and objectives of health and safety policies and procedures relevant to AFNR careers.
	1.3.3.2	Identify emergency response procedures for health and safety issues at AFNR workplaces.
	1.3.3.3	Examine and categorize examples of how to avoid health or safety risks in AFNR workplaces.
	1.3.3.4	Examine and categorize the risk level of contamination or injury as associated with AFNR tasks in the workplace.
	1.3.3.5	Analyze and evaluate the impact of current health and safety practices of AFNR workplaces.
	1.3.3.6	Assess various emergency response plan requirements for an AFNR workplaces and/or facility.
	1.3.3.7	Assess and apply first aid knowledge and procedures relevant to AFNR workplaces.
	1.3.3.8	Assess the safety priorities and select appropriate responses for different levels of contamination or injury at an AFNR workplace.
	1.3.3.9	Create and implement a health and safety policy plan for AFNR workplaces.
	1.3.3.10	Create and implement a plan to communicate appropriate responses for health and safety situations within an AFNR workplace.
	1.3.3.11	Conduct a survey and evaluate results of AFNR workplaces to identify structure of health and safety practices and number of employees certified in first aid training.
	1.3.3.12	Create a plan to mitigate the level of contamination or injury identified as a risk in the workplace.
1.3.4	**USE APPROPRIATE PROTECTIVE EQUIPMENT AND DEMONSTRATE SAFE AND PROPER USE OF AFNR TOOLS AND EQUIPMENT.**	
	1.3.4.1	Identify and differentiate the appropriate protective equipment for the safe use and operation of specific tools and equipment (e.g. PPE, etc.).

		1.3.4.2	Identify standard tools, equipment and safety procedures related to AFNR tasks.
		1.3.4.3	Read and interpret operating instructions related to operation, storage and maintenance of tools and equipment related AFNR tasks.
		1.3.4.4	Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment.
		1.3.4.5	Complete the set up and adjustment for tools and equipment related to AFNR tasks.
		1.3.4.6	Assess and demonstrate appropriate operation, storage, and maintenance techniques for AFNR tools and equipment.
		1.3.4.7	Design and implement plans to ensure the use of appropriate protective equipment when using various AFNR tools and equipment.
		1.3.4.8	Evaluate and select appropriate tools and equipment to complete AFNR tasks.
		1.3.4.9	Devise and implement operation, storage, and maintenance plans or schedules for AFNR tools and equipment.
Topic 1.4	***Demonstrate stewardship of natural resources in AFNR activities.***		
	Student Competencies		
	1.4.1	**IDENTIFY AND IMPLEMENT PRACTICES TO STEWARD NATURAL RESOURCES IN DIFFERENT AFNR SYSTEMS.**	
		1.4.1.1	Define stewardship of natural resources and distinguish how it connects to AFNR systems.
		1.4.1.2	Read and interpret the definition of sustainability and summarize how it relates to AFNR activities.
		1.4.1.3	Analyze available practices to steward natural resources in AFNR systems (e.g., wildlife and land conservation, soil and water practices, ecosystem management, etc.).
		1.4.1.4	Analyze and assess sustainability practices that can be applied in AFNR systems (e.g., energy efficiency, recycle/reuse/repurpose, green resources, etc.).
		1.4.1.5	Devise strategies for stewarding natural resources at home and within community.
		1.4.1.6	Evaluate sustainability policies and plans and prepare summary of potential improvements for AFNR businesses or organizations.
	1.4.2	**ASSESS AND EXPLAIN THE NATURAL RESOURCE RELATED TRENDS, TECHNOLOGIES, AND POLICIES THAT IMPACT AFNR SYSTEMS.**	
		1.4.2.1	Research and examine historical and current natural resources trends and technologies.
		1.4.2.2	Research and summarize influential historical and current natural resources policies that impact AFNR systems.
		1.4.2.3	Analyze natural resources trends and technologies and explain how they impact AFNR systems (e.g., climate change, green technologies, water resources, etc.).
		1.4.2.4	Create and defend a hypothetical natural resources policy that will impact current AFNR systems (e.g., for water resources, land use, air quality, etc.).
		1.4.2.5	Defend or challenge natural resources trends and technologies based upon an assessment of their impact on AFNR systems.

		1.4.2.6	Design and implement strategies for implementing a new natural resources policy that will positively impact AFNR systems.
Topic 1.5	***Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food, & Natural Resources career pathways.***		
	Student Competencies		
	1.5.1	**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.).**	
		1.5.1.1	Identify and summarize the steps to pursue a career in an AFNR pathway (e.g., self-assessment, set goals, etc.).
		1.5.1.2	Examine the educational, training, and experiential requirements to pursue a career in an AFNR pathway (e.g., degrees, certifications, training, internships, etc.).
		1.5.1.3	Research and summarize specific tools (e.g., resumes, portfolios, cover letters, etc.) and processes (e.g., interviews, applications, etc.) needed to pursue a career in an AFNR pathway.
		1.5.1.4	Create a personal plan outlining goals and steps to obtain a career in an AFNR pathway.
		1.5.1.5	Analyze personal skillset and create a plan for obtaining the required education, training, and experiences to obtain a career in an AFNR pathway.
		1.5.1.6	Assess personal goals, experiences, education, and skillsets and organize them to produce the appropriate tools and develop the skills to effectively communicate about one's qualifications for an AFNR career.
		1.5.1.7	Evaluate progress toward AFNR career goals and identify opportunities for improvement and necessary adjustments to one's plan of action.
		1.5.1.8	Implement one's personal plan of action for obtaining the required education, training, and experiences and evaluate progress to identify opportunities for improvement and necessary adjustments.
		1.5.1.9	Evaluate, update, and improve a set of personal tools to reflect current skills, experiences, education, goals, etc. and complete the processes needed to pursue and obtain a career in an AFNR pathway.
	1.5.2	**EXAMINE AND CHOOSE CAREER OPPORTUNITIES THAT ARE MATCHED TO PERSONAL SKILLS, TALENTS, AND CAREER GOALS IN AN AFNR PATHWAY OF INTEREST.**	
		1.5.2.1	Examine and categorize careers in each of the AFNR pathways.
		1.5.2.2	Research and describe careers in each of the AFNR pathways and choose potential careers connecting to personal interests and skills.
		1.5.2.3	Assess personal skills and align them with potential career opportunities in AFNR pathways.
		1.5.2.4	Assemble and analyze examples of careers and related statistics on a local, state, national, and global level.
		1.5.2.5	Interpret and evaluate the results of a personal career assessment and connect them to potential careers in AFNR pathways.

		1.5.2.6	Conduct interviews with career professionals within AFNR pathways and summarize the results.
Topic 1.6	***Analyze the interaction among AFNR systems in the production, processing, and management of food, fiber, and fuel and the sustainable use of natural resources.***		
	Student Competencies		
	1.6.1	**EXAMINE AND EXPLAIN FOUNDATIONAL CYCLES AND SYSTEMS OF AFNR.**	
		1.6.1.1	Research and explain the foundational cycles in AFNR (e.g., water cycle, nutrient cycle, carbon cycle, etc.).
		1.6.1.2	Examine and describe examples of systems within AFNR (e.g., sustainability, gate-to-plate, etc.).
		1.6.1.3	Analyze and explain how foundational cycles affect production, processing, and management of food, fiber, and fuel.
		1.6.1.4	Analyze AFNR systems and determine their impact on producing and processing food, fiber, and fuel.
		1.6.1.5	Teach others about the impact of foundational cycles within AFNR systems.
		1.6.1.6	Evaluate AFNR systems and predict how the systems may change or adapt in the future of food, fiber, and fuel production based on current trends and data.
	1.6.2	**ANALYZE AND EXPLAIN THE CONNECTION AND RELATIONSHIPS BETWEEN DIFFERENT AFNR SYSTEMS ON A NATIONAL AND GLOBAL LEVEL.**	
		1.6.2.1	Summarize how AFNR systems connect and relate on a national and global level (e.g., soil, water, economic, etc.).
		1.6.2.2	Examine and summarize changes that happen in AFNR systems on a national and global level (e.g., using less irrigation water, reduction of inputs, etc.).
		1.6.2.3	Analyze differences between AFNR systems on a national and global scale.
		1.6.2.4	Analyze the connections and relationships impacted when there is a change in an AFNR system on a national and global level.
		1.6.2.5	Evaluate how AFNR systems impact each other on a national and global level.
		1.6.2.6	Evaluate how changes in one AFNR system can benefit cost components of other systems on a national and global level.

Standard 2	AGRIBUSINESS SYSTEMS		
Topic 2.1	***Apply management planning principles in AFNR businesses.***		
	Student Competencies		
	2.1.1	**APPLY MICRO- AND MACROECONOMIC PRINCIPLES TO PLAN AND MANAGE INPUTS AND OUTPUTS IN AN AFNR BUSINESS.**	
		2.1.1.1	Examine and provide examples of microeconomic principles related to decisions about AFNR business inputs and outputs (e.g., supply, demand and equilibrium, elasticity, diminishing returns, opportunity cost, etc.).
		2.1.1.2	Examine and provide examples of macroeconomic principles related to AFNR businesses (e.g., Gross Domestic Product, inflation, capital accounts, unemployment rate, etc.).
		2.1.1.3	Define and research the nature of monetary policies in different global economic systems (e.g., traditional economic system, command economic system, market economic system, mixed economic system, etc.).
		2.1.1.4	Apply microeconomic principles to calculate values associated with different inputs and outputs in AFNR businesses (e.g., price, point of equilibrium, opportunity costs, marginal costs, etc.).
		2.1.1.5	Analyze and describe the relationship between AFNR business and industry outputs and domestic and global macroeconomic trends (e.g., Gross Domestic Product, national income, rate of growth, price levels, etc.).
		2.1.1.6	Assess the monetary policy in different countries and explain how it impacts AFNR businesses.
		2.1.1.7	Create strategies to maximize the efficiency of AFNR business inputs and outputs using microeconomic principles.
		2.1.1.8	Analyze the impact of the current macroeconomic environment on decisions related to AFNR businesses.
		2.1.1.9	Create recommendations for change in monetary policy according to a scenario related to an AFNR business.
	2.1.2	**READ, INTERPRET, EVALUATE AND WRITE STATEMENTS OF PURPOSE TO GUIDE BUSINESS GOALS, OBJECTIVES, AND RESOURCE ALLOCATION.**	
		2.1.2.1	Read and interpret statements of purpose (e.g., vision, mission statement, charter, etc.).
		2.1.2.2	Identify the meaning and importance of goals and objectives in AFNR business enterprises.
		2.1.2.3	Assess different approaches for creating statements of purpose for AFNR businesses and choose an appropriate approach to meet organizational needs.
		2.1.2.4	Prepare short-term, intermediate and long-term goals and objectives that are consistent with the statements of purpose for an AFNR business.
		2.1.2.5	Create and disseminate statements of purpose for activities in AFNR businesses.
		2.1.2.6	Evaluate AFNR business goals and objectives, then make revisions based on data and observations.

2.1.3	**DEVISE AND APPLY MANAGEMENT SKILLS TO ORGANIZE AND RUN AN AFNR BUSINESS IN AN EFFICIENT, LEGAL, AND ETHICAL MANNER.**	
	2.1.3.1	Define and provide examples of management skills used to organize an AFNR business (e.g., management types, organizational structures, time management techniques, conducting business agreements, etc.).
	2.1.3.2	Identify and interpret appropriate local, state, federal, international, and industry regulations that impact the management and operation of AFNR businesses.
	2.1.3.3	Identify and evaluate the presence or lack of ethical standards in planning and operating AFNR businesses.
	2.1.3.4	Analyze the effectiveness of different management skills used in an AFNR business.
	2.1.3.5	Assess and describe the positive and negative impact of local, state, federal, international, and industry regulations on the management and operation of AFNR businesses.
	2.1.3.6	Analyze the importance of using ethical standards and develop methods to communicate ethical standards within AFNR businesses.
	2.1.3.7	Devise strategies to improve the operation of AFNR businesses using management skills.
	2.1.3.8	Devise management or operational strategies to address and adhere to local, state, federal, international, and industry regulations.
	2.1.3.9	Design methods for AFNR businesses to implement ethical standards in management skills (e.g., management types, organizational structures, time management techniques, conducting business agreements, etc.).
2.1.4	**EVALUATE, DEVELOP AND IMPLEMENT PROCEDURES USED TO RECRUIT, TRAIN, AND RETAIN PRODUCTIVE HUMAN RESOURCES FOR AFNR BUSINESSES.**	
	2.1.4.1	Research and explain the meaning and functions of human resources in AFNR businesses (e.g., recruitment, evaluate employee performance, employee record management, compensation, etc.).
	2.1.4.2	Identify and explain programs used in AFNR businesses to recruit, train, and retain employees and define their purpose (e.g., career development, training plans, recruitment plans, evaluation programs, etc.).
	2.1.4.3	Research and summarize purposes and objectives of benefit and compensation plans for AFNR businesses.
	2.1.4.4	Create methods to describe specific positions and structures of an AFNR business to share with human resources (e.g., job descriptions, business information sheet, pamphlet, etc.).
	2.1.4.5	Analyze and evaluate programs used to recruit, train, and retain employees based on their effectiveness.
	2.1.4.6	Generate compliant and competitive benefit and compensation plans for AFNR business employees.
	2.1.4.7	Establish and maintain appropriate records and reports on human resources in AFNR businesses (e.g., personal records, absenteeism record, payroll data, employee requests, etc.).
	2.1.4.8	Design guidelines and programs to recruit, train and retain employees in AFNR businesses.

	2.1.4.9	Create recommendations for AFNR employers to improve current benefit and compensation plans (e.g., how to motivate employees, recognize productivity, equitably compensate, etc.).
Topic 2.2	***Use record keeping to accomplish AFNR business objectives, manage budgets, and comply with laws and regulations.***	
	Student Competencies	
	2.2.1	**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.).**
	2.2.1.1	Examine and describe accounting systems and procedures used for record keeping in AFNR businesses (e.g., cash vs. accrual systems, identification of appropriate accounts, double-entry accounting, entry of debits and credits, etc.).
	2.2.1.2	Research and summarize the features of different tools and services for recording, tracking, and auditing AFNR business transactions (e.g., electronic tools, paper-based tools, consultative services, online services, banking services, etc.).
	2.2.1.3	Research and examine the implications of applicable laws and regulations related to recording, tracking, and auditing AFNR business transactions (e.g., Generally Accepted Accounting Principles, data security, etc.).
	2.2.1.4	Evaluate the implementation and appropriateness of accounting systems and procedures used for record keeping in AFNR businesses.
	2.2.1.5	Compare and contrast the benefits and limitations of different tools and services for recording, tracking, and auditing AFNR business transactions (e.g., convenience, costs, data security, etc.).
	2.2.1.6	Predict and calculate the consequences of non-compliance with laws and regulations related to recording, tracking, and auditing accounting information in AFNR businesses.
	2.2.1.7	Select appropriate accounting systems and develop accounting procedures to maintain records for AFNR businesses.
	2.2.1.8	Recommend and select tools and services to track, record, and audit AFNR business transactions that meet business needs and priorities (e.g., electronic and paper based systems, etc.).
	2.2.1.9	Assess the degree to which AFNR accounting practices comply with laws and regulations related to recording, tracking, and auditing accounting information in AFNR businesses.
	2.2.2	**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.).**
	2.2.2.1	Compare and contrast the different types of financial reports (e.g., income statements, cash flow statements, equity statements, etc.) and their frequency of use (e.g., daily, weekly, monthly, quarterly, annual) for monitoring AFNR business performance.
	2.2.2.2	Research and summarize strategies for tracking, reporting and managing inventory in AFNR businesses (e.g., spreadsheets, databases, word processing, networked systems, the Internet, etc.).

	2.2.2.3	Define and classify different types of taxes that may be paid by AFNR businesses (e.g., income, property, sales, employment, estate, etc.).
	2.2.2.4	Prepare and interpret financial reports to describe the performance of AFNR businesses (e.g., efficiency, profitability, net worth, financial ratios, working capital ratio, leverage, etc.).
	2.2.2.5	Use accounting information to prepare financial reports associated with inventory in AFNR businesses (e.g., cost of goods sold, margins on goods, etc.).
	2.2.2.6	Analyze and describe reporting requirements for different types of taxes paid by AFNR businesses (e.g., income, property, sales, employment, etc.).
	2.2.2.7	Recommend appropriate financial reports to assemble to support specific AFNR business decisions (e.g., evaluating efficiency, profitability, net worth, financial ratios, etc.).
	2.2.2.8	Create recommendations to improve management of inventory in AFNR businesses (e.g., maintaining optimal levels, calculating costs of carrying input and output inventory, supply chain management, etc.).
	2.2.2.9	Assemble financial information to prepare tax filings for AFNR businesses.
Topic 2.3	***Manage cash budgets, credit budgets, and credit for an AFNR business using generally accepted accounting principles.***	
	Student Competencies	
2.3.1	**DEVELOP, ASSESS, & MANAGE CASH BUDGETS TO ACHIEVE AFNR BUSINESS GOALS.**	
	2.3.1.1	Compare and contrast components of cash budgets (e.g., anticipated revenue, production costs, overhead costs, profit, etc.) and identify the appropriate components to include in a budget given the nature of the AFNR enterprise.
	2.3.1.2	Research and summarize factors that impact management of cash budgets in AFNR businesses (e.g., changes in price of inputs/outputs, financial investment performance, capital purchases, human resources, etc.).
	2.3.1.3	Examine and interpret cash budgets for AFNR businesses.
	2.3.1.4	Examine and identify strategies to manage components of cash budgets to minimize liabilities and maximize profit in AFNR businesses (e.g., delayed payment of expenses, prepayment of expenses, etc.).
	2.3.1.5	Develop cash budgets for AFNR businesses.
	2.3.1.6	Predict the impact of management decisions on cash budgets in AFNR businesses.
2.3.2	**ANALYZE CREDIT NEEDS AND MANAGE CREDIT BUDGETS TO ACHIEVE AFNR BUSINESS GOALS.**	
	2.3.2.1	Research and summarize the characteristics of different types of credit instruments available to AFNR businesses (e.g., lines of credit, operating notes, alternative sources of capital, etc.).
	2.3.2.2	Examine and interpret the terms and conditions associated with credit instruments used in AFNR businesses (e.g., repayment terms, APR, grace periods, personal liability, interest rates, etc.).
	2.3.2.3	Analyze AFNR business needs to determine the necessity of loans for business operation.

		2.3.2.4	Compare and contrast strategies to responsibly manage credit budgets in AFNR businesses.
		2.3.2.5	Analyze and assemble the information needed to obtain credit for AFNR businesses.
		2.3.2.6	Analyze AFNR business needs and recommend appropriate uses of available credit budgets to meet goals.
Topic 2.4	***Develop a business plan for an AFNR business.***		
	Student Competencies		
	2.4.1	**ANALYZE CHARACTERISTICS AND PLANNING REQUIREMENTS ASSOCIATED WITH DEVELOPING BUSINESS PLANS FOR DIFFERENT TYPES OF AFNR BUSINESSES.**	
		2.4.1.1	Describe the meaning, importance, and economic impact of entrepreneurship on the AFNR industry and larger economy.
		2.4.1.2	Categorize the characteristics of the types of ownership structures used in AFNR businesses (e.g., sole proprietorships, cooperatives, partnerships, and corporations).
		2.4.1.3	Research and describe the components to include in a business plan for an AFNR business.
		2.4.1.4	Classify the characteristics of successful entrepreneurs in AFNR businesses.
		2.4.1.5	Compare and contrast business plans for different types of ownership structures used in AFNR businesses.
		2.4.1.6	Analyze the information needed and strategies to obtain the information to complete an AFNR business plan (e.g., SMART goals and objectives, needs assessment, cash flow projection, etc.).
		2.4.1.7	Demonstrate the application of entrepreneurial skills to conceptualize an AFNR business (e.g., idea generation, opportunity analysis, risk assessment, etc.).
		2.4.1.8	Generate conclusions about the successes and failures of AFNR businesses within the global economics system as related to the business ownership structure.
		2.4.1.9	Prepare a business plan for an AFNR business.
	2.4.2	**DEVELOP PRODUCTION AND OPERATIONAL PLANS FOR AN AFNR BUSINESS.**	
		2.4.2.1	Identify and define the components of operational plans in AFNR businesses (e.g., location, supply and inventory management, production and distribution, organization structure, etc.).
		2.4.2.2	Devise strategies to illustrate the production process of an AFNR business to produce a specific agricultural product.
		2.4.2.3	Compare and contrast the strengths and weaknesses of operational plans from different AFNR businesses to determine best practices.
		2.4.2.4	Identify and assess alternative production systems for a specific agricultural product.
		2.4.2.5	Make recommendations to improve operational plans for an AFNR business based on best practices.
		2.4.2.6	Create strategies to improve the production process of an agricultural product for an AFNR facility (e.g., SWOT strengths, weaknesses, opportunities, and threats; supply chain management; etc.).
	2.4.3	**IDENTIFY AND APPLY STRATEGIES TO MANAGE OR MITIGATE RISK.**	
		2.4.3.1	Assess and classify sources of risk for an AFNR business (e.g., financial risk, public perception of company, etc.).

	2.4.3.2	Research and summarize examples that illustrate the importance of risk and uncertainty within AFNR businesses.
	2.4.3.3	Risk management strategies for AFNR businesses (e.g., cash flow projection, analyze market trends, etc.).
	2.4.3.4	Analyze alternative approaches to reducing risk for AFNR businesses (e.g., insurance for product liability, property, production, or income loss for personnel life and health, etc.).
	2.4.3.5	Determine methods to match risk management strategies to risk situations in an AFNR business.
	2.4.3.6	Prepare a comprehensive risk management and contingency plan for an AFNR business.
Topic 2.5	***Use sales and marketing principles to accomplish AFNR business objectives.***	
	Student Competencies	
	2.5.1	**ANALYZE THE ROLE OF MARKETS, TRADE, COMPETITION AND PRICE IN RELATION TO AN AFNR BUSINESS SALES AND MARKETING PLANS.**
	2.5.1.1	Distinguish and explain markets related to AFNR businesses (e.g. commodity markets, energy markets, etc.).
	2.5.1.2	Research and summarize different forms of market competition found in AFNR businesses (e.g., direct competitors, indirect competitors, replacement competitors, etc.).
	2.5.1.3	Analyze and describe the role of trade and price in the market structure as it relates to AFNR businesses.
	2.5.1.4	Compare and contrast different forms of market competition and how they can be applied to different AFNR businesses.
	2.5.1.5	Evaluate and predict future trends for a specific AFNR product as related to markets, trade and price (e.g., corn, oil, wheat, etc.).
	2.5.1.6	Design and conduct experiments to determine market competition effectiveness of different AFNR businesses.
	2.5.2	**ASSESS AND APPLY SALES PRINCIPLES AND SKILLS TO ACCOMPLISH AFNR BUSINESS OBJECTIVES.**
	2.5.2.1	Identify and explain components of the sales process for AFNR businesses (e.g., understanding needs, develop solutions, close sale, etc.).
	2.5.2.2	Research and summarize examples of different types of sales calls used in AFNR businesses (e.g., cold calls, face-to-face meetings, follow up calls, etc.).
	2.5.2.3	Apply the sales process to AFNR businesses and communicate ways of accomplishing the businesses' goals and objectives.
	2.5.2.4	Assess different customer reactions that could be encountered during different types of sales calls used in AFNR businesses and prepare an appropriate response (e.g., objections, competitor prices, competing products, post-sale service, complaints about product, etc.).

	2.5.2.5	Analyze the sales process of AFNR businesses and create methods to suggest improvements.
	2.5.2.6	Create strategies for developing plans for different types of sales calls used in AFNR businesses.
2.5.3	**ASSESS MARKETING PRINCIPLES AND DEVELOP MARKETING PLANS TO ACCOMPLISH AFNR BUSINESS OBJECTIVES.**	
	2.5.3.1	Identify and explain marketing principles used in AFNR businesses (e.g., 4 P's [product, place, price, promotion]; attention, interest, desire, action, etc.).
	2.5.3.2	Research and categorize different strategies used in marketing programs for AFNR businesses (e.g., Internet, direct to customer, social media, etc.).
	2.5.3.3	Research and summarize the purpose, components and process to develop marketing plans for AFNR businesses.
	2.5.3.4	Assess and select appropriate alternative marketing strategies (e.g. value-adding, branding, niche marketing, etc.) for AFNR businesses using established marketing principles.
	2.5.3.5	Compare and contrast the strategies of marketing for products and services used in AFNR businesses (e.g., direct marketing, commodities, etc.).
	2.5.3.6	Perform a market analysis to gather information for marketing plans for AFNR businesses (e.g., evaluation of competitors, customers, domestic and international policy, regulations and rules, standards, etc.).
	2.5.3.7	Deconstruct and analyze current AFNR marketing plans to determine the effectiveness of implementation of marketing principles and alternative marketing strategies.
	2.5.3.8	Devise plans to implement and evaluate marketing strategies for products and services used in AFNR businesses.
	2.5.3.9	Construct comprehensive marketing plans for AFNR businesses.

Standard 3	ANIMAL SYSTEMS		
Topic 3.1	***Analyze historic and current trends impacting the animal systems industry.***		
	Student Competencies		
	3.1.1	**EVALUATE THE DEVELOPMENT AND IMPLICATIONS OF ANIMAL ORIGIN, DOMESTICATION, AND DISTRIBUTION ON PRODUCTION PRACTICES AND THE ENVIRONMENT.**	
		3.1.1.1	Identify and summarize the origin, significance, distribution, and domestication of different animal species.
		3.1.1.2	Research and summarize major components of animal systems (e.g., livestock, companion animal, etc.).
		3.1.1.3	Evaluate and describe characteristics of animals that developed in response to the animal's environment and led to their domestication.
		3.1.1.4	Describe the historical and scientific developments of different animal industries and summarize the products, services, and careers associated with each.
		3.1.1.5	Evaluate the implications of animal adaptations on production practices and the environment.
		3.1.1.6	Predict trends and implications of future developments within different animal industries on production practices and the environment.
	3.1.2	**ASSESS AND SELECT ANIMAL PRODUCTION METHODS FOR USE IN ANIMAL SYSTEMS BASED UPON THEIR EFFECTIVENESS AND IMPACTS.**	
		3.1.2.1	Identify and categorize terms and methods related to animal production (e.g., sustainable, conventional, humanely raised, natural, organic, etc.).
		3.1.2.2	Research and examine marketing methods for animal products and services (e.g., conventional, niche markets, locally grown, etc.).
		3.1.2.3	Summarize the types, purposes, and characteristics of effective record keeping and documentation practices for animal systems enterprises (e.g., managing records for animal identification, feeding, breeding, treatment, income/expense, etc.).
		3.1.2.4	Identify and summarize wildlife management methods.
		3.1.2.5	Analyze the impact of animal production methods on end product qualities (e.g., price, sustainability, marketing, labeling, animal welfare, etc.).
		3.1.2.6	Calculate costs of marketing versus predicted increases in sales.
		3.1.2.7	Analyze and evaluate the accuracy and effectiveness of records used in an animal system business.
		3.1.2.8	Research and summarize local wildlife populations, challenges and ecological measures that are being utilized.
		3.1.2.9	Evaluate the effectiveness of different production methods and defend the use of selected methods using data and evidence.
		3.1.2.10	Devise and evaluate marketing plans for an animal agriculture product or service.

		3.1.2.11	Select and defend the use of a specific record management system based upon its effectiveness for a business related to animal systems.
		3.1.2.12	Devise and evaluate plans to manage wildlife populations to achieve optimal ecological health.
	3.1.3	**ANALYZE AND APPLY LAWS AND SUSTAINABLE PRACTICES TO ANIMAL AGRICULTURE FROM A GLOBAL PERSPECTIVE.**	
		3.1.3.1	Distinguish between the types of laws pertaining to animal systems.
		3.1.3.2	Research and summarize sustainability in animal systems.
		3.1.3.3	Analyze the structure of laws governing animal industries, international trade, and animal production policies.
		3.1.3.4	Analyze the local and global impact of sustainable animal agriculture practices on human and environmental systems.
		3.1.3.5	Evaluate the impact of laws pertaining to animal agriculture (e.g., pros, cons, effect on individuals, effect on businesses, etc.) and assess the compliance of production practices with established regulations.
		3.1.3.6	Select, evaluate and defend the use of sustainable practices in animal agriculture.
Topic 3.2	***Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.***		
	Student Competencies		
	3.2.1	**DEMONSTRATE MANAGEMENT TECHNIQUES THAT ENSURE ANIMAL WELFARE.**	
		3.2.1.1	Explain the implications of animal welfare and animal rights for animal systems.
		3.2.1.2	Research and summarize the challenges involved in working with animals and resources available to overcome them (e.g., tools, technology, equipment, facilities, animal behavior signals, etc.).
		3.2.1.3	Distinguish between animal husbandry practices that promote animal welfare and those that do not.
		3.2.1.4	Design programs that assure the welfare of animals and prevent abuse or mistreatment.
		3.2.1.5	Analyze and document animal welfare procedures used to ensure safety and maintain low stress when moving and restraining animals.
		3.2.1.6	Analyze and document animal husbandry practices and their impact on animal welfare.
		3.2.1.7	Implement and evaluate quality-assurance programs and procedures for animal production.
		3.2.1.8	Devise, implement and evaluate safety procedures and plans for working with animals by species using information based on animal behavior and responses.
		3.2.1.9	Devise economical recommendations to increase the welfare of animals in animal systems.
	3.2.2	**ANALYZE PROCEDURES TO ENSURE THAT ANIMAL PRODUCTS ARE SAFE FOR CONSUMPTION (E.G., USE IN FOOD SYSTEM, ETC.).**	
		3.2.2.1	Identify and categorize tools, technology and equipment used in animal husbandry and welfare to help provide an abundant and safe food supply.
		3.2.2.2	Research and summarize animal production practices that may pose health risks.
		3.2.2.3	Identify and describe animal tracking systems used in animal systems (e.g., livestock, companion animal, exotics, etc.).

	3.2.2.4	Utilize tools, technology, and equipment to perform animal husbandry and welfare tasks.
	3.2.2.5	Analyze consumer concerns with animal production practices relative to human health.
	3.2.2.6	Analyze and summarize the impact of animal trace-back capabilities on producers and consumers.
	3.2.2.7	Select, evaluate and defend the use of specific tools, technology, or equipment used to perform animal husbandry and welfare tasks.
	3.2.2.8	Research and evaluate programs to assure the safety of animal products for consumption.
	3.2.2.9	Evaluate the effectiveness of animal and/or premise identification programs for a given species.
Topic 3.3	***Design and provide proper animal nutrition to achieve desired outcomes for performance, development, reproduction, and/or economic production.***	
	Student Competencies	
	3.3.1	**ANALYZE THE NUTRITIONAL NEEDS OF ANIMALS.**
	3.3.1.1	Identify and summarize essential nutrients required for animal health and analyze each nutrient's role in growth and performance.
	3.3.1.2	Differentiate between nutritional needs of animal species.
	3.3.1.3	Differentiate between nutritional needs of animals in different growth stages and production systems (e.g., maintenance, gestation, natural, organic, etc.).
	3.3.1.4	Correlate a species' nutritional needs to feedstuffs that could meet those needs.
	3.3.1.5	Assess nutritional needs for an individual animal based on its growth stage and production system.
	3.3.1.6	Design and defend the use of a nutritional program by demonstrating the relationship between the nutrient requirements and the feedstuffs provided.
	3.3.2	**ANALYZE FEED RATIONS AND ASSESS IF THEY MEET THE NUTRITIONAL NEEDS OF ANIMALS.**
	3.3.2.1	Compare and contrast common types of feedstuffs and the roles they play in the diets of animals.
	3.3.2.2	Examine the importance of a balanced ration for animals based on the animal's growth stage (e.g., maintenance, newborn, gestation, lactation, etc.).
	3.3.2.3	Examine the purpose, impact and mode of action of feed additives and growth promotants in animal production.
	3.3.2.4	Determine the relative nutritional value of feedstuffs by evaluating their general quality and condition.
	3.3.2.5	Appraise the adequacy of feed rations using data from the analysis of feedstuffs, animal requirements, and performance.
	3.3.2.6	Compare and contrast methods that utilize feed additives and growth promotants with production practices that do not (e.g., organic versus conventional production methods).
	3.3.2.7	Select appropriate feedstuffs for animals based on a variety of factors (e.g., economics, digestive system, and nutritional needs, etc.).
	3.3.2.8	Select and utilize animal feeds based on nutritional requirements, using rations for maximum nutrition and optimal economic production.

		3.3.2.9	Make and defend decisions regarding whether to use feed additives and growth promotants after researching and considering scientific evidence, production system needs and goals, and input from industry professionals.
	3.3.3	**UTILIZE INDUSTRY TOOLS TO MAKE ANIMAL NUTRITION DECISIONS.**	
		3.3.3.1	Identify and categorize tools and equipment used to meet animal nutrition needs and ensure an abundant and safe food supply.
		3.3.3.2	Examine and summarize the meaning of various components of feed labels and feeding directions.
		3.3.3.3	Examine the use of technology to provide animal nutrition.
		3.3.3.4	Utilize tools and equipment to perform animal nutrition tasks.
		3.3.3.5	Analyze and apply information from a feed label and feeding directions to feed animals.
		3.3.3.6	Analyze technologies used to provide animal nutrition and summarize their potential benefits and consequences.
		3.3.3.7	Select, evaluate, and defend the use of specific tools or equipment used to perform animal nutrition tasks.
		3.3.3.8	Evaluate and summarize the potential impacts, positive and negative, of compliance and/or noncompliance with a feed label and feeding directions.
		3.3.3.9	Research and recommend technology improvements to provide proper nutrition to animals.
Topic 3.4	***Apply principles of animal reproduction to achieve desired outcomes for performance, development, and/or economic production.***		
	Student Competencies		
	3.4.1	**EVALUATE ANIMALS FOR BREEDING READINESS AND SOUNDNESS.**	
		3.4.1.1	Identify and categorize the male and female reproductive organs of the major animal species.
		3.4.1.2	Compare and contrast how age, size, life cycle, maturity level, and health status affect the reproductive efficiency of male and female animals.
		3.4.1.3	Summarize the importance of efficient and economic reproduction in animals.
		3.4.1.4	Analyze the functions of major organs in the male and female reproductive systems.
		3.4.1.5	Assess and describe factors that lead to reproductive maturity.
		3.4.1.6	Evaluate reproductive problems that occur in animals.
		3.4.1.7	Select breeding animals based on characteristics of the reproductive organs.
		3.4.1.8	Evaluate and select animals for reproductive readiness.
		3.4.1.9	Treat or cull animals with reproductive problems.
	3.4.2	**APPLY SCIENTIFIC PRINCIPLES TO SELECT AND CARE FOR BREEDING ANIMALS.**	
		3.4.2.1	Summarize genetic inheritance in animals.
		3.4.2.2	Identify and summarize inheritance and terms related to inheritance in animal breeding (e.g., dominate, co-dominate, recessive, homozygous, heterozygous, etc.).
		3.4.2.3	Identify and summarize genetic defects that affect animal performance.

		3.4.2.4	Identify and summarize different needs of breeding animals based on their growth stages (e.g., newborn, parturition, gestation, gestation lengths, etc.).
		3.4.2.5	Compare and contrast the use of genetically superior animals in the production of animals and animal products.
		3.4.2.6	Demonstrate how to determine probability trait inheritance in animals.
		3.4.2.7	Analyze how DNA analysis can detect genetic defects in breeding stock.
		3.4.2.8	Analyze the care needs for breeding stock in each stage of growth.
		3.4.2.9	Select and evaluate a breeding system based on the principles of genetics.
		3.4.2.10	Select and evaluate breeding animals and determine the probability of a given trait in their offspring.
		3.4.2.11	Perform a DNA analysis and use the data to make and defend breeding decisions.
		3.4.2.12	Create a plan to differentiate care of a species of breeding animals throughout their growth stages.
	3.4.3	**APPLY SCIENTIFIC PRINCIPLES TO BREED ANIMALS.**	
		3.4.3.1	Identify and categorize natural and artificial breeding methods (e.g., natural breeding, artificial insemination, estrous synchronization, flushing, cloning, etc.).
		3.4.3.2	Analyze the materials, methods and processes of artificial insemination.
		3.4.3.3	Identify and summarize the advantages and disadvantages of major reproductive management practices, including estrous synchronization, superovulation, flushing, and embryo transfer (e.g., cost, labor, equipment, etc.).
		3.4.3.4	Examine the use of quantitative breeding values (e.g., EPDs, Performance records, pedigrees) in the selection of genetically superior breeding stock.
		3.4.3.5	Calculate the potential economic benefits of natural versus artificial breeding methods.
		3.4.3.6	Demonstrate artificial insemination techniques.
		3.4.3.7	Analyze the processes of major reproductive management practices, including estrous synchronization, superovulation, flushing, and embryo transfer.
		3.4.3.8	Compare and contrast quantitative breeding value differences between genetically superior animals and animals of average genetic value.
		3.4.3.9	Select animal breeding methods based on reproductive and economic efficiency.
		3.4.3.10	Evaluate the implementation and effectiveness of artificial insemination techniques.
		3.4.3.11	Create and evaluate plans and procedures for estrous synchronization, superovulation, flushing, embryo transfer, and other reproductive management practices.
		3.4.3.12	Select and assess animal performance based on quantitative breeding values for specific characteristics.
Topic 3.5	***Evaluate environmental factors affecting animal performance and implement procedures for enhancing performance and animal health.***		
	Student Competencies		
	3.5.1	**DESIGN ANIMAL HOUSING, EQUIPMENT, AND HANDLING FACILITIES FOR THE MAJOR SYSTEMS OF ANIMAL PRODUCTION.**	

		3.5.1.1	Differentiate between the types of facilities needed to house and produce animal species safely and efficiently.
		3.5.1.2	Identify and summarize equipment, technology, and handling facility procedures used in modern animal production (e.g., climate control devices, sensors, automation, etc.).
		3.5.1.3	Critique designs for an animal facility and prescribe alternative layouts and adjustments for the safe, sustainable, and efficient use of the facility.
		3.5.1.4	Analyze the use of modern equipment, technology, and handling facility procedures and determine if they enhance the safe, economic and sustainable production of animals.
		3.5.1.5	Design an animal facility focusing on animal requirements, economic efficiency, sustainability, safety, and ease of handling.
		3.5.1.6	Select, use, and evaluate equipment, technology, and handling procedures to enhance sustainability and production efficiency.
	3.5.2	**COMPLY WITH GOVERNMENT REGULATIONS AND SAFETY STANDARDS FOR FACILITIES USED IN ANIMAL PRODUCTION.**	
		3.5.2.1	Identify and summarize the general standards that must be met in facilities for animal production (e.g., environmental, zoning, construction, etc.).
		3.5.2.2	Distinguish between the types of laws and regulations pertaining to animal systems.
		3.5.2.3	Analyze animal facilities to determine if standards have been met.
		3.5.2.4	Analyze the structure of laws pertaining to animal systems.
		3.5.2.5	Evaluate facility designs and make recommendations to ensure that it meets standards for the legal, safe, ethical, economical, and efficient production of animals.
		3.5.2.6	Evaluate the impact of laws pertaining to animal systems.
Topic 3.6	***Classify, evaluate, and select animals based on anatomical and physiological characteristics.***		
	Student Competencies		
	3.6.1	**CLASSIFY ANIMALS ACCORDING TO TAXONOMIC CLASSIFICATION SYSTEMS AND USE (E.G. AGRICULTURAL, COMPANION, ETC.).**	
		3.6.1.1	Explain the importance of the binomial nomenclature system for classifying animals.
		3.6.1.2	Compare and contrast major uses of different animal species (e.g., agricultural, companion, etc.).
		3.6.1.3	Identify and summarize common classification terms utilized in animal systems (e.g., external and internal body parts, maturity, mature male, immature female, animal products, breeds, etc.).
		3.6.1.4	Explain how animals are classified using a taxonomic classification system.
		3.6.1.5	Appraise and evaluate the economic value of animals for various applications in the agriculture industry.
		3.6.1.6	Analyze the visual characteristics of an animal or animal product and select correct classification terminology when referring to companion and production animals.
		3.6.1.7	Assess taxonomic characteristics and classify animals according to the taxonomic classification system.

	3.6.1.8	Recommend different uses for an animal species based upon an analysis of local market needs.
	3.6.1.9	Apply knowledge of classification terms to communicate with others about animal systems in an effective and accurate manner.
3.6.2	**APPLY PRINCIPLES OF COMPARATIVE ANATOMY AND PHYSIOLOGY TO USES WITHIN VARIOUS ANIMAL SYSTEMS.**	
	3.6.2.1	Research and summarize characteristics of a typical animal cell and identify the organelles.
	3.6.2.2	Examine the basic functions of animal cells in animal growth and reproduction.
	3.6.2.3	Identify and summarize the properties, locations, functions, and types of animal cells, tissues, organs, and body systems.
	3.6.2.4	Analyze the functions of each animal cell structure.
	3.6.2.5	Analyze the processes of meiosis and mitosis in animal growth, development, health, and reproduction.
	3.6.2.6	Compare and contrast animal cells, tissues, organs, body systems types, and functions among animal species.
	3.6.2.7	Correlate the functions of animal cell structures to animal growth, development, health, and reproduction.
	3.6.2.8	Apply the processes of meiosis and mitosis to solve animal growth, development, health, and reproductive problems.
	3.6.2.9	Apply knowledge of anatomical and physiological characteristics of animals to make production and management decisions.
3.6.3	**SELECT AND TRAIN ANIMALS FOR SPECIFIC PURPOSES AND MAXIMUM PERFORMANCE BASED ON ANATOMY AND PHYSIOLOGY.**	
	3.6.3.1	Identify and summarize how an animal's health can be affected by anatomical and physiological disorders.
	3.6.3.2	Evaluate an animal against its optimal anatomical and physiological characteristics.
	3.6.3.3	Research and summarize the use of products and by-products derived from animals.
	3.6.3.4	Compare and contrast desirable anatomical and physiological characteristics of animals within and between species.
	3.6.3.5	Compare and contrast procedures to sustainably and efficiently develop an animal to reach its highest performance potential with respect to its anatomical and physiological characteristics.
	3.6.3.6	Evaluate and select products from animals based on industry standards.
	3.6.3.7	Evaluate and select animals to maximize performance based on anatomical and physiological characteristics that affect health, growth, and reproduction.
	3.6.3.8	Choose, implement, and evaluate sustainable and efficient procedures (e.g., selection, housing, nutrition, and management) to produce consistently high-quality animals that are well suited for their intended purposes.
	3.6.3.9	Evaluate and select animals to produce superior animal products based on industry standards.

Topic 3.7	*Apply principles of effective animal health care.*	
	Student Competencies	
	3.7.1	**DESIGN PROGRAMS TO PREVENT ANIMAL DISEASES, PARASITES, AND OTHER DISORDERS AND ENSURE ANIMAL WELFARE.**
	3.7.1.1	Identify and summarize specific tools and technology used in animal health management.
	3.7.1.2	Explain methods of determining animal health and disorders.
	3.7.1.3	List and summarize the characteristics of wounds, common diseases, parasites, and physiological disorders that affect animals.
	3.7.1.4	Identify and summarize characteristics of causal agents and vectors of diseases and disorders in animals.
	3.7.1.5	Explain the clinical significance of common veterinary methods and treatment (e.g., aseptic techniques, antibiotic use, wound management, etc.).
	3.7.1.6	Describe and demonstrate the proper use and function of specific tools and technology related to animal health management.
	3.7.1.7	Perform simple health-check evaluations on animals and practice basic emergency response procedures related to animals.
	3.7.1.8	Identify and describe common illnesses and disorders of animals based on symptoms and problems caused by wounds, diseases, parasites, and physiological disorders.
	3.7.1.9	Research and analyze data to evaluate preventive measures for controlling and limiting the spread of diseases, parasites, and disorders among animals.
	3.7.1.10	Assess the safety and effectiveness of facilities and equipment used for surgical and nonsurgical veterinary treatments and procedures.
	3.7.1.11	Select and use tools and technology to meet specific animal health management goals.
	3.7.1.12	Determine when an animal health concern needs to be referred to an animal health professional.
	3.7.1.13	Treat common diseases, parasites and physiological disorders of animals according to directions prescribed by an animal health professional.
	3.7.1.14	Design and implement a health maintenance and a disease and disorder prevention plan for animals in their natural and/or confined environments.
	3.7.1.15	Identify and describe surgical and nonsurgical veterinary treatments and procedures to meet specific animal health care objectives.
	3.7.2	**ANALYZE BIOSECURITY MEASURES UTILIZED TO PROTECT THE WELFARE OF ANIMALS ON A LOCAL, STATE, NATIONAL, AND GLOBAL LEVEL.**
	3.7.2.1	Summarize the importance of biosecurity to the animal industry at multiple levels (e.g., local, state, national, global).
	3.7.2.2	Identify and describe zoonotic diseases including their historical significance and potential future implications.
	3.7.2.3	Analyze procedures at the local, state, and national levels to ensure biosecurity of the animal industry.

		3.7.2.4	Analyze the health risk of different zoonotic diseases to humans and identify prevention methods.
		3.7.2.5	Design and evaluate a biosecurity plan for an animal production operation.
		3.7.2.6	Research and evaluate the effectiveness of zoonotic disease prevention methods and procedures to identify those that are best suited to ensure public safety and animal welfare.
Topic 3.8	***Analyze environmental factors associated with animal production.***		
	Student Competencies		
	3.8.1	**DESIGN AND IMPLEMENT METHODS TO REDUCE THE EFFECTS OF ANIMAL PRODUCTION ON THE ENVIRONMENT.**	
		3.8.1.1	Identify and summarize the effects of animal agriculture on the environment (e.g., waste disposal, carbon footprint, air quality, environmental efficiencies, etc.).
		3.8.1.2	Assess the effectiveness of methods of reducing the effects of animal agriculture on the environment.
		3.8.1.3	Devise a plan that includes measures to reduce the impact of animal agriculture on the environment.
	3.8.2	**EVALUATE THE EFFECTS OF ENVIRONMENTAL CONDITIONS ON ANIMALS AND CREATE PLANS TO ENSURE FAVORABLE ENVIRONMENTS FOR ANIMALS.**	
		3.8.2.1	Research and summarize environmental conditions that impact animals (e.g., weather, sources of water, food resources, etc.).
		3.8.2.2	Identify and summarize methods for ensuring optimal environmental conditions for animals.
		3.8.2.3	Critique the reliability and validity of evidence presented to support claims regarding the effects of environmental conditions on animal populations and performance (e.g., population changes, emerging species, extinction, etc.).
		3.8.2.4	Implement and evaluate the effectiveness of methods to ensure optimal environmental conditions for animals.
		3.8.2.5	Apply valid and reliable research evidence to predict the potential effects of different environmental conditions for an animal population.
		3.8.2.6	Devise and improve plans to establish favorable environmental conditions for animal growth and performance based on a variety of factors (e.g., economic feasibility, environmental sustainability, impact on animals, etc.).

Standard 4	BIOTECHNOLOGY SYSTEMS		
Topic 4.1	***Assess factors that have influenced the evolution of biotechnology in agriculture (e.g., historical events, societal trends, ethical, and legal implications, etc.).***		
	Student Competencies		
	4.1.1	**INVESTIGATE AND EXPLAIN THE RELATIONSHIP BETWEEN PAST, CURRENT AND EMERGING APPLICATIONS OF BIOTECHNOLOGY IN AGRICULTURE (E.G., MAJOR INNOVATORS, HISTORICAL DEVELOPMENTS, POTENTIAL APPLICATIONS OF BIOTECHNOLOGY, ETC.).**	
		4.1.1.1	Research and summarize the evolution of biotechnology in agriculture.
		4.1.1.2	Examine and categorize current applications and gains achieved in applying biotechnology to agriculture.
		4.1.1.3	Distinguish between current and emerging applications of biotechnology in agriculture.
		4.1.1.4	Compare and contrast the benefits and risks of biotechnology compared with alternative approaches to improving agriculture.
		4.1.1.5	Analyze the developmental progression of biotechnology and the evolution of scientific knowledge.
		4.1.1.6	Assess and summarize current work in biotechnology being done to add value to agricultural and society.
		4.1.1.7	Analyze and document emerging problems and issues associated with agricultural biotechnology.
		4.1.1.8	Assess the benefits and risks associated with using biotechnology to improve agriculture.
		4.1.1.9	Evaluate and explain how scientists use the scientific method to build upon previous findings in current and emerging research.
		4.1.1.10	Evaluate the outcomes and impacts of biotechnology on the globalization of agriculture.
		4.1.1.11	Design a potential application of biotechnology to meet emerging agricultural and societal needs.
		4.1.1.12	Evaluate the short-term and long-term benefits and risks of applying biotechnology to agriculture.
	4.1.2	**EVALUATE THE SCOPE AND IMPLICATIONS OF REGULATORY AGENCIES ON APPLICATIONS OF BIOTECHNOLOGY IN AGRICULTURE AND PROTECTION OF PUBLIC INTERESTS (E.G., HEALTH, SAFETY, ENVIRONMENTAL ISSUES, ETC.).**	
		4.1.2.1	Compare and contrast differences between regulatory systems worldwide.
		4.1.2.2	Research and document major regulatory issues related to biotechnology in agriculture.
		4.1.2.3	Explain the relationship between regulatory agencies and the protection of public interests such as health, safety, and the environment.
		4.1.2.4	Assess and summarize the role and scope of agencies that regulate biotechnology.
		4.1.2.5	Analyze the impact major regulatory issues have on public acceptance of biotechnology in agriculture.
		4.1.2.6	Research and summarize factors and data that regulatory agencies use to evaluate the potential risks a new application of biotechnology may pose to health, safety, and the environment.
		4.1.2.7	Explain and critique a decision made by a major agency that regulates agricultural biotechnology.

		4.1.2.8	Critique and propose a solution for a major regulatory issue pertaining to biotechnology in agriculture.
		4.1.2.9	Evaluate data to determine if new technologies present a major regulatory issue to health, safety, and/or the environment.
	4.1.3	**ANALYZE THE RELATIONSHIP AND IMPLICATIONS OF BIOETHICS, LAWS, AND PUBLIC PERCEPTIONS ON APPLICATIONS OF BIOTECHNOLOGY IN AGRICULTURE (E.G., ETHICAL, LEGAL, SOCIAL, CULTURAL ISSUES).**	
		4.1.3.1	Research and summarize the emergence, evolution, and implications of bioethics associated with biotechnology in agriculture.
		4.1.3.2	Research and summarize legal issues related to biotechnology in agriculture (e.g., protection of intellectual property through patents, copyright, trademarks, etc.).
		4.1.3.3	Research and summarize public perceptions of biotechnology in agriculture (e.g., social and cultural issues).
		4.1.3.4	Analyze the implications bioethics may have on future advancements in AFNR.
		4.1.3.5	Determine the significance and impacts of legal issues related to biotechnology in agriculture.
		4.1.3.6	Analyze the impact of public perceptions on the application of biotechnology in different AFNR systems.
		4.1.3.7	Devise and support an argument for or against an ethical issue associated with biotechnology in agriculture.
		4.1.3.8	Propose a solution for a legal issue associated with biotechnology in agriculture.
		4.1.3.9	Design studies to examine public perceptions of scientifically-based arguments regarding biotechnology in agriculture and reflect on the reasons why the public may support or resist significant breakthroughs using biotechnology.
Topic 4.2	***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.).***		
	Student Competencies		
	4.2.1	**READ, DOCUMENT, EVALUATE, AND SECURE ACCURATE LABORATORY RECORDS OF EXPERIMENTAL PROTOCOLS, OBSERVATIONS, AND RESULTS.**	
		4.2.1.1	Compare and contrast common record-keeping methods used in a laboratory (e.g., paper notebook, electronic notebook, etc.).
		4.2.1.2	Research and summarize the need for data and information security in a laboratory and demonstrate best practices.
		4.2.1.3	Evaluate the role of bioinformatics in agriculture and summarize the types of databases that are available (e.g., genomic, transcriptomics, etc.).
		4.2.1.4	Maintain and interpret laboratory records documented in a laboratory to ensure data accuracy and integrity (e.g., avoid bias, record any conflicts of interest, avoid misinterpreted results, etc.).

	4.2.1.5	Assess when security procedures for data and information collected in a laboratory should be implemented.
	4.2.1.6	Analyze and document the security procedures for data collected using bioinformatics.
	4.2.1.7	Evaluate the strengths and weaknesses of using research documentation and propose improvements to ensure study reproduction and utility in future studies.
	4.2.1.8	Devise a strategy for ensuring the security of data and information collected in a laboratory.
	4.2.1.9	Critique an application of bioinformatics to solve an agricultural issue and recommend procedures for keeping the information safe.
4.2.2	**IMPLEMENT STANDARD OPERATING PROCEDURES FOR THE PROPER MAINTENANCE, USE, AND STERILIZATION OF EQUIPMENT IN A LABORATORY.**	
	4.2.2.1	Identify, interpret, and implement standard operating procedures for laboratory equipment.
	4.2.2.2	Categorize and identify laboratory equipment according to its purpose in scientific research.
	4.2.2.3	Differentiate between sterilization techniques for equipment in a laboratory (e.g., media bottles vs. laminar flow hood, etc.).
	4.2.2.4	Develop a maintenance program for laboratory equipment based upon the standard operating procedures.
	4.2.2.5	Manipulate basic laboratory equipment and measurement devices (e.g., water bath, electrophoresis equipment, micropipettes, laminar flow hood, etc.).
	4.2.2.6	Create a plan for sterilizing equipment in a laboratory according to standard operating procedures.
	4.2.2.7	Perform ongoing maintenance of laboratory equipment according to the standard operating procedures (e.g., calibration, testing, etc.).
	4.2.2.8	Operate advanced laboratory equipment and measurement devices (e.g., thermal cycler, imaging system, etc.).
	4.2.2.9	Perform sterilization techniques for equipment in a laboratory using standard operating procedures.
4.2.3	**APPLY STANDARD OPERATING PROCEDURES FOR THE SAFE HANDLING OF BIOLOGICAL AND CHEMICAL MATERIALS IN A LABORATORY.**	
	4.2.3.1	Classify and document basic aseptic techniques in the laboratory.
	4.2.3.2	Examine and implement standard operating procedures for the use of biological materials according to directions and their classification (e.g., proper handling of bacteria or DNA before, during and after use).
	4.2.3.3	Categorize and label the types of solutions that are commonly prepared in a laboratory (e.g., buffers, reagents, media, etc.).
	4.2.3.4	Demonstrate advanced aseptic techniques in the laboratory (e.g., sterile work area, sterile handling, personal hygiene, etc.).
	4.2.3.5	Analyze and select an appropriate standard operating procedure for working with biological materials based upon their classification.
	4.2.3.6	Formulate and prepare solutions using standard operating procedures (e.g., proper labeling, storage, etc.).

	4.2.3.7	Conduct assays and experiments under aseptic conditions.
	4.2.3.8	Create a standard operating procedure for a biological process.
	4.2.3.9	Verify the physical properties of solutions (e.g., molarity, percent mass/volume, dilutions, etc.).
4.2.4	**SAFELY MANAGE AND DISPOSE OF BIOLOGICAL MATERIALS, CHEMICALS, AND WASTES ACCORDING TO STANDARD OPERATING PROCEDURES.**	
	4.2.4.1	Classify different types of personal protective equipment and demonstrate how to properly utilize the equipment.
	4.2.4.2	Classify and describe hazards associated with biological and chemical materials.
	4.2.4.3	Summarize what happens to waste after it leaves the laboratory and identify opportunities to reduce waste and unnecessary costs.
	4.2.4.4	Assess the need for personal protective equipment in a variety of situations and select the appropriate equipment to wear when working with biological and chemical materials.
	4.2.4.5	Inventory biological and chemical materials and maintain accurate records of supplies and expiration dates.
	4.2.4.6	Perform waste disposal according to the standard operating procedures.
	4.2.4.7	Evaluate the benefits and limitations of personal protective equipment.
	4.2.4.8	Create a plan for stocking and maintaining supplies of biological and chemical materials in a laboratory.
	4.2.4.9	Propose a management plan to reduce laboratory waste and prevent ecological or health problems related to waste disposal.
4.2.5	**EXAMINE AND PERFORM SCIENTIFIC PROCEDURES USING MICROBES, DNA, RNA, AND PROTEINS IN A LABORATORY.**	
	4.2.5.1	Differentiate types of organisms and demonstrate safe handling to maintain organism purity and personal safety (e.g., plant and animal tissue, cell cultures, microbes, etc.).
	4.2.5.2	Compare and contrast the structures of DNA and RNA and investigate how genotype influences phenotype.
	4.2.5.3	Extract and purify DNA and RNA according to standard operating procedures.
	4.2.5.4	Examine and document the role and applications of proteins in agricultural biotechnology.
	4.2.5.5	Synthesize the relationship between proteins, enzymes, and antibodies.
	4.2.5.6	Characterize the physical and biological properties of organisms.
	4.2.5.7	Analyze and interpret the molecular basis for heredity and the tools and techniques used in DNA and RNA manipulations.
	4.2.5.8	Perform electrophoretic techniques and interpret electrophoresis fragmentation patterns (e.g., gel electrophoresis, southern blotting, etc.).
	4.2.5.9	Demonstrate protein separation techniques and interpret the results.
	4.2.5.10	Analyze and document how antibodies are formed and describe how they can be used in agricultural biotechnology.
	4.2.5.11	Isolate, maintain, quantify and store cell cultures according to standard operating procedures.

	4.2.5.12	Evaluate factors that influence gene expression.
	4.2.5.13	Manipulate and analyze DNA and RNA through advanced scientific procedures (e.g., southern blotting, cloning, PCR, RT-PCR, etc.).
	4.2.5.14	Evaluate the biochemical properties of proteins to explain their function and predict potential uses.
	4.2.5.15	Use antibodies to detect and quantify antigens by conducting an Enzyme- Linked Immunosorbent Assay (ELISA).
Topic 4.3	***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.).***	
	Student Competencies	
	4.3.1	**APPLY BIOTECHNOLOGY PRINCIPLES, TECHNIQUES, AND PROCESSES TO CREATE TRANSGENIC SPECIES THROUGH GENETIC ENGINEERING.**
	4.3.1.1	Summarize biological, social, agronomic, and economic reasons for genetic modification of eukaryotes.
	4.3.1.2	Summarize the process of transformation of eukaryotic cells with transgenic DNA.
	4.3.1.3	Analyze the benefits and risks associated with the use of biotechnology to increase productivity and improve quality of living species (e.g., plants, animals such as aquatic species, etc.).
	4.3.1.4	Define and summarize epigenetics and synthesize the relationship between mutation, migration, and evolution of transgenes in the environment.
	4.3.1.5	Analyze and document the processes and describe the techniques used to produce transgenic eukaryotes (e.g., microbial synthetic biology, gene knockout therapy, traditional gene insertion, etc.).
	4.3.1.6	Assess and argue the pros and cons of transgenic species in agriculture.
	4.3.1.7	Research and evaluate genetic engineering procedures used in the production of living species.
	4.3.1.8	Analyze data to identify changes and patterns of transgenic species in the environment.
	4.3.1.9	Design and conduct experiments to evaluate an existing transgenic eukaryote.
	4.3.1.10	Transform plant or animal cells by performing a cellular transformation.
	4.3.1.11	Conduct field or clinical trials for genetically modified species.
	4.3.1.12	Conduct studies to track the movement of transgenes in the environment.
	4.3.2	**APPLY BIOTECHNOLOGY PRINCIPLES, TECHNIQUES, AND PROCESSES TO ENHANCE THE PRODUCTION OF FOOD THROUGH THE USE OF MICROORGANISMS AND ENZYMES.**
	4.3.2.1	Summarize reasons for detecting microbes and identify sources of microbes.
	4.3.2.2	Examine enzymes, the changes they cause and the physical and chemical parameters that affect enzymatic reactions (e.g., food, cellulosic bioenergy, etc.).
	4.3.2.3	Identify and categorize foods produced through the use of biotechnology (e.g., fermentation, etc.) to change the chemical properties of food for an intended purpose (e.g., create desirable nutritional profile, preservation, flavor, etc.).
	4.3.2.4	Assess and describe the use of biotechnology to detect microbes.

	4.3.2.5	Analyze processes by which enzymes are produced through biotechnology.
	4.3.2.6	Compare and contrast the effectiveness, purpose, and outcomes associated with biotechnology as well as conventional processes used in food processing.
	4.3.2.7	Design and perform an assay to detect a target microorganism in food, water, or the environment.
	4.3.2.8	Conduct studies using scientific techniques to improve or discover enzymes for use in biotechnology (e.g., microbial strain selection).
	4.3.2.9	Process food using biotechnology to achieve an intended purpose (e.g., preservation, flavor enhancement, etc.).
4.3.3	**APPLY BIOTECHNOLOGY PRINCIPLES, TECHNIQUES, AND PROCESSES TO PROTECT THE ENVIRONMENT AND MAXIMIZE USE OF NATURAL RESOURCES (E.G., BIOMASS, BIOPROSPECTING, INDUSTRIAL BIOTECHNOLOGY, ETC.).**	
	4.3.3.1	Examine the consequences of agricultural practices on natural populations.
	4.3.3.2	Define and summarize industrial biotechnology and categorize the benefits and risks associated with its use in manufacturing (e.g., fabrics, plastics, etc.).
	4.3.3.3	Research and summarize the potential applications of bioprospecting in biotechnology and agriculture.
	4.3.3.4	Analyze how biotechnology can be used to monitor the effects of agricultural practices on natural populations.
	4.3.3.5	Apply the processes used in the production of molecules for use in industrial applications.
	4.3.3.6	Assess and document the pros and cons of bioprospecting to achieve a research or product development objective.
	4.3.3.7	Evaluate the impact of modified organisms on the natural environment.
	4.3.3.8	Monitor and evaluate processes used in the synthesis of a molecule.
	4.3.3.9	Propose opportunities to use bioprospecting after weighing the short-term and long-term impacts on the environment.
4.3.4	**APPLY BIOTECHNOLOGY PRINCIPLES, TECHNIQUES, AND PROCESSES TO ENHANCE PLANT AND ANIMAL CARE AND PRODUCTION (E.G., SELECTIVE BREEDING, PHARMACEUTICALS, BIODIVERSITY, ETC.).**	
	4.3.4.1	Research and describe the aims and techniques involved in selective plant-breeding process.
	4.3.4.2	Examine and classify biotechnology processes applicable to animal health (e.g., genetic testing, etc.).
	4.3.4.3	Research and categorize the types of pharmaceuticals developed for animals and humans through biotechnology.
	4.3.4.4	Summarize the need for global biodiversity and applications of biotechnology to reduce threats to biodiversity.
	4.3.4.5	Choose techniques and identify tools used to monitor and direct plant breeding.
	4.3.4.6	Assess the benefits, risks, and opportunities associated with using biotechnology to promote animal health.

	4.3.4.7	Distinguish the difference between plant-based and animal-based pharmaceuticals and describe their role in agriculture.
	4.3.4.8	Assess whether current threats to biodiversity will have an unsustainable impact on human populations.
	4.3.4.9	Perform plant-breeding techniques (e.g., plant tissue culture, etc.).
	4.3.4.10	Design animal-care protocols to ethically monitor and promote animal systems associated with biotechnology.
	4.3.4.11	Evaluate the process used to produce pharmaceuticals from transgenic organisms (e.g., hormones for animals, etc.).
	4.3.4.12	Select and utilize techniques to measure biodiversity in a population.
4.3.5	**APPLY BIOTECHNOLOGY PRINCIPLES, TECHNIQUES, AND PROCESSES TO PRODUCE BIOFUELS (E.G., FERMENTATION, TRANSESTERIFICATION, METHANOGENESIS, ETC.).**	
	4.3.5.1	Examine and synthesize the need for biofuels (e.g., cellulosic bioenergy, etc.).
	4.3.5.2	Differentiate between biomass and sources of biomass.
	4.3.5.3	Research and explain the process of fermentation and its potential applications.
	4.3.5.4	Define and summarize the process of transesterification and its potential applications.
	4.3.5.5	Examine the process of methanogenesis and its potential applications.
	4.3.5.6	Analyze the impact of the production and use of biofuels on the environment.
	4.3.5.7	Assess the characteristics of biomass that make it useful for biofuels production.
	4.3.5.8	Correlate the relationship between fermentation and the process used to produce alcohol from biomass.
	4.3.5.9	Analyze and document the process used to produce biodiesel from biomass.
	4.3.5.10	Analyze and describe the process used to produce methane from biomass.
	4.3.5.11	Evaluate and support how biofuels could solve a global issue (e.g., environmental, agricultural, etc.).
	4.3.5.12	Conduct a review of the technologies used to create biofuels from biomass and weigh the pros and cons of each method.
	4.3.5.13	Produce alcohol and co-products from biomass.
	4.3.5.14	Produce biodiesel and co-products from biomass.
	4.3.5.15	Produce methane and co-products from biomass.
4.3.6	**APPLY BIOTECHNOLOGY PRINCIPLES, TECHNIQUES, AND PROCESSES TO IMPROVE WASTE MANAGEMENT (E.G., GENETICALLY MODIFIED ORGANISMS, BIOREMEDIATION, ETC.).**	
	4.3.6.1	Compare and contrast the use of natural organisms and genetically-engineered organisms in the treatment of wastes.
	4.3.6.2	Summarize the purpose of microorganisms in biological waste management.
	4.3.6.3	Analyze the role of microorganisms in industrial chemical waste treatment.
	4.3.6.4	Provide examples of instances in which bioremediation can be applied to clean up environmental contaminants.
	4.3.6.5	Analyze the process by which organisms are genetically engineered for waste treatment.

	4.3.6.6	Assess and describe the processes involved in biotreatment of biological wastes.
	4.3.6.7	Evaluate and describe the processes involved in biotreatment of industrial chemical wastes.
	4.3.6.8	Analyze and summarize the risks and benefits of using biotechnology for bioremediation.
	4.3.6.9	Conduct studies to evaluate the treatment of a waste product using a genetically engineered organism.
	4.3.6.10	Monitor and evaluate the treatment of biological wastes with microorganisms.
	4.3.6.11	Monitor and review the treatment of industrial chemical wastes with microorganisms.
	4.3.6.12	Design a bioremediation project including plans to evaluate the effectiveness of the effort.

Standard 5	ENVIRONMENTAL SERVICE SYSTEMS		
Topic 5.1	***Use analytical procedures and instruments to manage environmental service systems.***		
	Student Competencies		
	5.1.1	**ANALYZE AND INTERPRET LABORATORY AND FIELD SAMPLES IN ENVIRONMENTAL SERVICE SYSTEMS.**	
		5.1.1.1	Identify sample types and sampling techniques used to collect laboratory and field data.
		5.1.1.2	Identify methods of statistical analysis commonly used in research (e.g., mean, standard deviation, standard error, error bars, etc.).
		5.1.1.3	Determine the appropriate sampling techniques needed to generate data.
		5.1.1.4	Summarize the purpose of statistical analysis methods commonly used in environmental service systems research and explain examples of their use in practice.
		5.1.1.5	Collect and prepare sample measurements using appropriate data collection techniques.
		5.1.1.6	Utilize data analysis to identify trends in a data sample and assess the confidence that can be drawn from those conclusions.
	5.1.2	**PROPERLY UTILIZE SCIENTIFIC INSTRUMENTS IN ENVIRONMENTAL MONITORING SITUATIONS (E.G., LABORATORY EQUIPMENT, ENVIRONMENTAL MONITORING INSTRUMENTS, ETC.).**	
		5.1.2.1	Identify basic laboratory equipment and explain their uses.
		5.1.2.2	Identify basic environmental monitoring instruments and explain their uses.
		5.1.2.3	Demonstrate the proper use and maintenance of basic laboratory equipment.
		5.1.2.4	Demonstrate the proper use and maintenance of environmental monitoring instruments.
		5.1.2.5	Calibrate and use laboratory equipment according to standard operating procedures.
		5.1.2.6	Calibrate and use environmental monitoring instruments according to standard operating procedures.
Topic 5.2	***Evaluate the impact of public policies and regulations on environmental service system operations.***		
	Student Competencies		
	5.2.1	**INTERPRET AND EVALUATE THE IMPACT OF LAWS, AGENCIES, POLICIES, AND PRACTICES AFFECTING ENVIRONMENTAL SERVICE SYSTEMS.**	
		5.2.1.1	Distinguish between the types of laws associated with environmental service systems.
		5.2.1.2	Distinguish between the types of government agencies (i.e., local, state, and federal) associated with environmental service systems.
		5.2.1.3	Research policies, practices and initiatives common in business and advocacy groups associated with environmental service systems (e.g., zero-waste, LEED-certified, locally-grown, etc.).
		5.2.1.4	Analyze the structure of laws associated with environmental service systems.
		5.2.1.5	Analyze the specific purpose of government agencies associated with environmental service systems.
		5.2.1.6	Assess the intent, feasibility, and effectiveness of policies, practices, and initiatives common in business and advocacy groups associated with environmental service systems.

	5.2.1.7	Evaluate the impact of laws associated with environmental service systems for their impact on wildlife, people, the environment and the economy.
	5.2.1.8	Evaluate the impact and effectiveness of government agencies (i.e., local, state, and federal) associated with environmental service systems (e.g., regulation of consumption, prevention of damage to natural resources systems, management of ecological interactions, etc.).
	5.2.1.9	Evaluate the impact of policies, practices, and initiatives common in business and advocacy groups associated with environmental service systems on wildlife, people, the environment, and the economy.
5.2.2	**COMPARE AND CONTRAST THE IMPACT OF CURRENT TRENDS ON REGULATION OF ENVIRONMENTAL SERVICE SYSTEMS (E.G., CLIMATE CHANGE, POPULATION GROWTH, INTERNATIONAL TRADE, ETC.).**	
	5.2.2.1	Research and categorize the purpose, implementation, and impact of greenhouse gas emission policies (e.g., cap-and-trade, emission offsetting, zero-emissions, carbon-neutrality, carbon sequestration, etc.).
	5.2.2.2	Research the impact of environmental service systems regulations on international trade.
	5.2.2.3	Examine and summarize the impact that population growth has on environmental service systems.
	5.2.2.4	Research current policies related to fracking and shale oil gas.
	5.2.2.5	Assess the effectiveness and impact of greenhouse gas emissions policies.
	5.2.2.6	Analyze how environmental service systems regulations can both negatively and positively affect international trade.
	5.2.2.7	Analyze the correlation between increased population size and the need for regulation of environmental service systems.
	5.2.2.8	Assess whether current policies related to fracking and shale oil gas sufficiently address the needs of environmental service systems.
	5.2.2.9	Devise new policies for controlling greenhouse gas emissions that reduce atmospheric carbon levels while generating additional economic activity.
	5.2.2.10	Interpret and evaluate the impact of specific environmental service regulation policies (e.g., Clean Air Act, EISA, Clean Water Act, Superfund, etc.) on international trade.
	5.2.2.11	Predict the impact of future population growth on the regulation of environmental service systems and evaluate how changes made today will impact future regulations.
	5.2.2.12	Evaluate current fracking policies and create suggestions for modification of these policies to more thoroughly address the needs related to environmental, economic, and social sustainability.
5.2.3	**EXAMINE AND SUMMARIZE THE IMPACT OF PUBLIC PERCEPTIONS AND SOCIAL MOVEMENTS ON THE REGULATION OF ENVIRONMENTAL SERVICE SYSTEMS.**	
	5.2.3.1	Research and summarize how the perception and regulation of environmental service systems has changed over time.

	5.2.3.2	Examine how social views and movements (e.g., zero-waste philosophy, carbon footprints, recycling, etc.) have affected the implementation and need for regulation of environmental service systems.
	5.2.3.3	Analyze and summarize specific changes to perceptions and regulations of environmental service systems and their impact on reducing the ecological, economical, and sociological impact.
	5.2.3.4	Assess the effectiveness of specific social movements related to regulation of environmental service systems.
	5.2.3.5	Evaluate the impact of specific historical figures, or organizations, on the perception and regulation of environmental service systems.
	5.2.3.6	Research current issues related to modern or future environmental service systems and devise strategies for engaging the public to address these issues through social movements.
Topic 5.3	***Develop proposed solutions to environmental issues, problems, and applications using scientific principles of meteorology, soil science, hydrology, microbiology, chemistry, and ecology.***	
	Student Competencies	
	5.3.1	**APPLY METEOROLOGY PRINCIPLES TO ENVIRONMENTAL SERVICE SYSTEMS.**
	5.3.1.1	Distinguish between the different components and structural layers of the earth's atmosphere.
	5.3.1.2	Analyze how meteorological conditions influence air quality.
	5.3.1.3	Research climate change and summarize evidence that climate change is occurring.
	5.3.1.4	Examine and summarize factors that affect the earth's balance of energy.
	5.3.1.5	Differentiate how components of the atmosphere (e.g., weather systems and patterns, structure of the atmosphere, etc.) affect environmental service systems.
	5.3.1.6	Analyze and articulate the relationship between meteorological conditions, air quality, and air pollutants.
	5.3.1.7	Assess the environmental, economic, and social consequences of climate change.
	5.3.1.8	Analyze the basics of the greenhouse effect and describe how the greenhouse effect alters the earth's balance of energy.
	5.3.1.9	Utilize meteorological data to assess the impact of atmospheric conditions on environmental service systems.
	5.3.1.10	Interpret data measuring air pollution to determine its threat on human populations and ecological interactions.
	5.3.1.11	Evaluate the predicted impacts of global climate change on environmental service systems.
	5.3.1.12	Utilize data to predict and forecast future levels of greenhouse gas pollution and outline steps necessary to mitigate the resulting damage.
	5.3.2	**APPLY SOIL SCIENCE AND HYDROLOGY PRINCIPLES TO ENVIRONMENTAL SERVICE SYSTEMS.**
	5.3.2.1	Differentiate and distinguish land uses, capability factors, and land capability classes.
	5.3.2.2	Research and describe the process of soil formation through weathering.

	5.3.2.3	Examine and explain how the physical qualities of the soil influence the infiltration and percolation of water.
	5.3.2.4	Summarize environmental hazards associated with groundwater supplies.
	5.3.2.5	Research and summarize hydrogeology and differentiate between groundwater and surface water.
	5.3.2.6	Research and describe how groundwater and surface water interactions affect the existence of wetlands.
	5.3.2.7	Use a soil survey to determine the land capability classes for different parcels of land in an area.
	5.3.2.8	Differentiate rock types and relate the chemical composition of mineral matter in soils to the parent material.
	5.3.2.9	Assess the physical qualities of the soil that determine its potential for filtration of groundwater supplies and likelihood for flooding.
	5.3.2.10	Assess the effectiveness of precautions taken to prevent or reduce contamination of groundwater supplies.
	5.3.2.11	Analyze how interactions between groundwater and surface water affect flow and availability of water.
	5.3.2.12	Analyze the importance of the roles played by wetlands in regards to water availability, prevention of flooding, and other factors.
	5.3.2.13	Design a master land-use management plan for a given area that utilizes land capability classes in order to minimize erosion and flooding, maximize development and preservation of topsoil, etc.
	5.3.2.14	Evaluate the soil composition in order to predict the impact of that soil on environmental service systems.
	5.3.2.15	Conduct tests of soil to determine its potential for filtration of groundwater supplies and likelihood for flooding.
	5.3.2.16	Evaluate the methods used in a given example to protect groundwater supplies.
	5.3.2.17	Construct explanations and solutions to situations involving the declining availability of water that incorporate groundwater flow equations as well as human activity.
	5.3.2.18	Evaluate and select strategies for wetlands preservation and restoration that maximize services provided by wetlands while taking human concerns into consideration.
5.3.3	**APPLY CHEMISTRY PRINCIPLES TO ENVIRONMENTAL SERVICE SYSTEMS.**	
	5.3.3.1	Examine and summarize how chemistry affects soil structure and function (e.g., pH, cation-exchange capacity, filtration capability, flooding likelihood, etc.).
	5.3.3.2	Examine and summarize how chemistry affects water quality and function (e.g., oxygen saturation, pH, biomagnification, etc.).
	5.3.3.3	Examine and summarize how chemistry affects air quality and function (e.g., heat retention, formation of smog and acid rain, etc.).
	5.3.3.4	Examine and summarize the relationship between water and soil chemistry and the formation of different kinds of wetlands (e.g., fens, peat bogs, potholes, etc.).

	5.3.3.5	Analyze the soil chemistry of a sample.
	5.3.3.6	Analyze the water chemistry of a sample.
	5.3.3.7	Analyze how components of atmospheric chemistry (e.g., air chemical components, heat, moisture, etc.) affect air quality.
	5.3.3.8	Assess how different kinds of wetlands are formed based on the different kinds of soil and water chemistry present in each case.
	5.3.3.9	Evaluate a sample's soil chemistry and assess how the results may impact considerations in environmental service systems.
	5.3.3.10	Evaluate a sample's water chemistry and assess how the results may impact considerations in environmental service systems.
	5.3.3.11	Assess the impact of atmospheric chemistry on operational decisions in environmental service systems.
	5.3.3.12	Evaluate the services provided by types of wetlands and predict how different types of wetlands respond to pressures due to human activity.
5.3.4	**APPLY MICROBIOLOGY PRINCIPLES TO ENVIRONMENTAL SERVICE SYSTEMS.**	
	5.3.4.1	Describe the microbial biodiversity found in soil and summarize the contribution of microbial biodiversity to the physical and chemical characteristics of soil.
	5.3.4.2	Research and describe how microbial populations in an ecosystem affect carbon cycling.
	5.3.4.3	Examine and explain the role that microbes play in wastewater treatment.
	5.3.4.4	Research the purposes of bioassay tests and describe potential applications for environmental service systems.
	5.3.4.5	Assess how the activities of microorganisms in soil affect environmental service systems and ecosystem biodiversity.
	5.3.4.6	Analyze the microbial populations present in an area and assess how carbon cycling is affected.
	5.3.4.7	Assess the impact of wastewater treatment on environmental service systems.
	5.3.4.8	Analyze procedures for a bioassay test.
	5.3.4.9	Evaluate how soil microorganisms in environmental service systems can be used to minimize waste, maximize nutrient cycling and increase ecosystem biodiversity.
	5.3.4.10	Develop strategies for negating air pollutants based on soil microbial populations (e.g., carbon sequestration and rates of decomposition).
	5.3.4.11	Evaluate modern uses of microbial waste water treatment and devise strategies to further reduce the environmental, economic, and social impact of wastewater treatment.
	5.3.4.12	Conduct bioassay tests related to environmental service systems and interpret results.
5.3.5	**APPLY ECOLOGY PRINCIPLES TO ENVIRONMENTAL SERVICE SYSTEMS.**	
	5.3.5.1	Research the role that biodiversity plays in environmental service systems and how biodiversity can be measured.
	5.3.5.2	Examine and explain the role played by habitats on environmental service systems.

	5.3.5.3	Research and explain how carrying capacities relate to environmental service systems (e.g., waste processing, rate or production of pollution, disease, etc.).
	5.3.5.4	Examine and describe how ecological interactions can be used to assess environmental service systems (i.e., macroinvertebrates and/or amphibians as bioindicators).
	5.3.5.5	Calculate the amount of biodiversity in a given area using an appropriate method (e.g., quadrat assessment, transect measurements, etc.).
	5.3.5.6	Assess the impact of the current rate of habitat loss on environmental service systems.
	5.3.5.7	Assess and describe the impact of a population exceeding its carrying capacity on environmental service systems.
	5.3.5.8	Evaluate the benefits and drawbacks of using bioindicator species in environmental service systems.
	5.3.5.9	Evaluate the biodiversity of an area and predict the impact of changing the levels of biodiversity on environmental service systems.
	5.3.5.10	Evaluate the importance of habitat to environmental service systems and devise strategies to minimize the future loss of habitats.
	5.3.5.11	Devise a strategy for monitoring and supporting environmental service systems through management of a species' carrying capacity.
	5.3.5.12	Utilize evidence from bioindicator species to detect pollutants in a given area.
Topic 5.4	***Demonstrate the operation of environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management, and energy conservation).***	
	Student Competencies	
5.4.1	**USE POLLUTION CONTROL MEASURES TO MAINTAIN A SAFE FACILITY AND ENVIRONMENT.**	
	5.4.1.1	Identify and distinguish types of pollution and distinguish between point source and nonpoint source pollution.
	5.4.1.2	Research ways in which pollution can be managed and prevented and propose solutions to meet the needs of local systems.
	5.4.1.3	Interpret the conditions necessary for waste to be labeled as hazardous.
	5.4.1.4	Assess how industrial and nonindustrial pollution has damaged the environment.
	5.4.1.5	Conduct tests to determine the presence and extent of pollution.
	5.4.1.6	Classify examples of pollution as hazardous or nonhazardous.
	5.4.1.7	Evaluate evidence for a given area for industrial and nonindustrial pollution.
	5.4.1.8	Create a plan for pollution remediation, management, or prevention for a given area.
	5.4.1.9	Construct a plan for handling hazardous waste in given situations.
5.4.2	**MANAGE SAFE DISPOSAL OF ALL CATEGORIES OF SOLID WASTE IN ENVIRONMENTAL SERVICE SYSTEMS.**	
	5.4.2.1	Compare and contrast different types of solid waste and options for treating solid waste.
	5.4.2.2	Examine and describe the components of disposing waste in sanitary landfills.
	5.4.2.3	Research and summarize the benefits and processes of composting.

	5.4.2.4	Examine and describe the importance and potential impact of recycling.
	5.4.2.5	Analyze environmental hazards created by different types of solid waste, solid waste accumulation, and solid waste disposal.
	5.4.2.6	Analyze and document basic sanitary landfill operating procedures and design.
	5.4.2.7	Apply scientific principles to explain the benefits and processes of composting.
	5.4.2.8	Analyze and document different recycling methods and classify materials that can be recycled.
	5.4.2.9	Develop a plan for solid waste disposal for a given situation that considers the environmental hazards, economic realities, and social concerns associated with this task.
	5.4.2.10	Evaluate sanitary landfill procedures for environmental, economic, and social sustainability.
	5.4.2.11	Evaluate the appropriateness of composting methods in different situations.
	5.4.2.12	Survey and evaluate recycling programs and procedures.
5.4.3	**APPLY TECHNIQUES TO ENSURE A SAFE SUPPLY OF DRINKING WATER AND ADEQUATE TREATMENT OF WASTEWATER ACCORDING TO APPLICABLE RULES AND REGULATIONS.**	
	5.4.3.1	Categorize chemical and physical properties of drinking water.
	5.4.3.2	Research methods commonly used to treat wastewater and septic waste.
	5.4.3.3	Analyze and document all steps in the public drinking water treatment process according to applicable standards.
	5.4.3.4	Analyze and document the steps necessary to ensure that wastewater and septic waste can be safely released into the environment.
	5.4.3.5	Evaluate samples of water and the processes necessary to verify that the samples are safe for consumption according to applicable standards.
	5.4.3.6	Evaluate examples of wastewater and/or septic waste for its potential to cause environmental, economic, and/or social problems.
5.4.4	**COMPARE AND CONTRAST THE IMPACT OF CONVENTIONAL AND ALTERNATIVE ENERGY SOURCES ON THE ENVIRONMENT AND OPERATION OF ENVIRONMENTAL SERVICE SYSTEMS.**	
	5.4.4.1	Research conventional energy sources and list conservation measures to reduce the impact on environmental service systems.
	5.4.4.2	Research alternative energy sources and describe the motivations for seeking alternatives to conventional energy sources as they relate to environmental monitoring.
	5.4.4.3	Examine the factors that affect energy consumption and describe how these factors are related to environmental monitoring.
	5.4.4.4	Research the impact on environmental service systems that occur because of energy consumption.
	5.4.4.5	Examine and explain how energy consumption and the carbon cycle relate to environmental monitoring.
	5.4.4.6	Research and describe the purpose and applications of life cycle assessments to environmental service systems.

	5.4.4.7	Assess the advantages and disadvantages of conventional energy sources in regards to environmental service systems.
	5.4.4.8	Identify advantages and disadvantages of alternative energy sources as they pertain to environmental service systems.
	5.4.4.9	Analyze and document the main categories of energy consumption.
	5.4.4.10	Analyze and document the most significant impacts that energy consumption has on environmental monitoring.
	5.4.4.11	Calculate the impact of the carbon cycle imbalance (due to energy consumption) and assess how this imbalance affects environmental service systems.
	5.4.4.12	Interpret a life cycle assessment and explain how it can be utilized in environmental service systems to assess the potential ecological impact of an energy source.
	5.4.4.13	Evaluate the impact burning of fossil fuels has on environmental service systems.
	5.4.4.14	Evaluate the impact alternative energy sources have on environmental conditions.
	5.4.4.15	Evaluate strategies for reducing energy consumption to determine the most effective course of action based on the needs of environmental service systems.
	5.4.4.16	Devise a strategy for improving future energy consumption in a manner consistent with the intents of environmental service systems.
	5.4.4.17	Use data from environmental monitoring to evaluate methods for reducing the imbalance in the carbon cycle through changes to energy consumption.
	5.4.4.18	Conduct a life cycle assessment for a given source of energy and use this assessment to determine the best option for energy in regards to environmental service systems.
Topic 5.5	***Use tools, equipment, machinery, & technology common to tasks in environmental service systems.***	
	Student Competencies	
	5.5.1	**USE TECHNOLOGICAL AND MATHEMATICAL TOOLS TO MAP LAND, FACILITIES AND INFRASTRUCTURE FOR ENVIRONMENTAL SERVICE SYSTEMS.**
	5.5.1.1	Examine the importance and describe applications of surveying and mapping for environmental service systems.
	5.5.1.2	Research the methods in which GIS can be used in environmental service systems (e.g., tracing of point pollution, control of the spread of invasive species, etc.).
	5.5.1.3	Research how advancements in technology (e.g., unmanned aerial vehicles and drones, genetic modification, fracking, alternative energy, etc.) have changed environmental service systems.
	5.5.1.4	Apply surveying and mapping principles to a situation involving environmental service systems and identify and explain the use of equipment for surveying and mapping.
	5.5.1.5	Apply GIS skills to a situation specific to environmental service systems.
	5.5.1.6	Analyze and document examples of utilization of breaking technology in environmental service systems.

	5.5.1.7	Demonstrate surveying and cartographic skills to make site measurements in order to address concerns and needs within an environmental service systems situation.
	5.5.1.8	Interpret and evaluate GIS data to come to a conclusion about a scenario specific to environmental service systems.
	5.5.1.9	Evaluate trends in technology and develop predictions about how these advancements will change environmental service systems.
5.5.2	**PERFORM ASSESSMENTS OF ENVIRONMENTAL CONDITIONS USING EQUIPMENT, MACHINERY, AND TECHNOLOGY.**	
	5.5.2.1	Research and summarize methods used to determine water quality (e.g., dissolved oxygen, chemical tests, macroinvertebrates, etc.) and determine if a source of water has been contaminated.
	5.5.2.2	Research and summarize methods and tools used to measure soil health and determine if an area of land has been contaminated (e.g., soil probes, core monolith, soil fertility tests, etc.).
	5.5.2.3	Research and summarize methods and tools used to determine air quality and determine if pollution is present (e.g., CO2 probe, particulate matter sampler, etc.).
	5.5.2.4	Research and summarize methods used to determine ecological health and determine if an ecosystem is threatened (e.g., quadrat analysis, bioindicators, mark-recapture, etc.).
	5.5.2.5	Assess different measurements of water quality to determine their effectiveness and limitations.
	5.5.2.6	Assess different measurements of soil quality (e.g., soil horizons, soil texture, organic matter, soil respiration, etc.) to determine their effectiveness and limitations.
	5.5.2.7	Assess different measurements of air quality (e.g., ozone, carbon monoxide, particulate matter, etc.) to determine their effectiveness and limitations.
	5.5.2.8	Assess different measurements of assessing ecological health (e.g., quadrat biodiversity assessments, transect surveys, population counts, detection of disease, and invasive species, etc.) to determine their effectiveness and limitations.
	5.5.2.9	Evaluate a sample of water to determine its quality and if it has been contaminated.
	5.5.2.10	Evaluate a sample of soil to determine its quality and if it has been contaminated.
	5.5.2.11	Perform an evaluation of air quality to determine and assess its impact of human and ecological populations.
	5.5.2.12	Evaluate a habitat to determine its ecological quality and if it is threatened.

Standard 6	FOOD PRODUCTS AND PROCESSING SYSTEMS		
Topic 6.1	***Develop and implement procedures to ensure safety, sanitation, and quality in food product and processing facilities.***		
	Student Competencies		
	6.1.1	**ANALYZE AND MANAGE OPERATIONAL AND SAFETY PROCEDURES IN FOOD PRODUCTS AND PROCESSING FACILITIES.**	
		6.1.1.1	Research and summarize the purposes and objectives of safety programs in food products and processing facilities (e.g., Sanitation Standard Operating Procedures (SSOP); Good Manufacturing Practices (GMP); worker safety, etc.).
		6.1.1.2	Research and categorize types of equipment used in food products and processing systems.
		6.1.1.3	Analyze and document attributes and procedures of current safety programs in food products and processing facilities.
		6.1.1.4	Assess specifications and maintenance needs for equipment and facilities used in food products and processing systems (e.g., specifications for machines, sanitation procedures, repair protocol, etc.).
		6.1.1.5	Construct plans that ensure implementation of safety programs for food products and processing facilities.
		6.1.1.6	Devise and implement strategies to maintain equipment and facilities for food products and processing systems.
	6.1.2	**APPLY FOOD SAFETY AND SANITATION PROCEDURES IN THE HANDLING AND PROCESSING OF FOOD PRODUCTS TO ENSURE FOOD QUALITY.**	
		6.1.2.1	Examine and identify contamination hazards associated with food products and processing (e.g., physical, chemical, and biological).
		6.1.2.2	Research and summarize procedures of safe handling protocols (e.g., Hazard Analysis and Critical Control Points Plan (HACCP); Critical Control Point procedures (CCP); Good Agricultural Practices Plan (GAP), etc.).
		6.1.2.3	Research and summarize the purposes and objectives of quality assurance tests on food products (e.g., produce safety regulation, safe food transport, food contaminants, etc.).
		6.1.2.4	Describe the effects foodborne pathogens have on food products and humans.
		6.1.2.5	Outline procedures to eliminate possible contamination hazards associated with food products and processing.
		6.1.2.6	Construct plans that ensure implementation of safe handling procedures on food products.
		6.1.2.7	Design and construct experiments for quality assurance tests on food products.
		6.1.2.8	Explain, document, and execute the procedures of microbiological tests used to detect food-borne pathogens.
		6.1.2.9	Identify sources of contamination in food products and/or processing facilities and develop ways to eliminate contamination.

		6.1.2.10	Examine, interpret, and report outcomes from safe handling procedures and results from quality assurance tests.
		6.1.2.11	Interpret and evaluate results of quality assurance tests on food products and examine steps to implement corrective procedures.
		6.1.2.12	Conduct and interpret microbiological tests for food-borne pathogens.
	6.1.3	**APPLY FOOD SAFETY PROCEDURES WHEN STORING FOOD PRODUCTS TO ENSURE FOOD QUALITY.**	
		6.1.3.1	Identify and summarize purposes of food storage procedures (e.g., first in/first out, temperature regulation, monitoring, etc.).
		6.1.3.2	Research and describe different electronic and paper-based documentation methods used to meet food safety and quality goals in food products and processing systems.
		6.1.3.3	Analyze characteristics of food products and determine appropriate storage procedures.
		6.1.3.4	Demonstrate and explain methods of documentation procedures within food products and processing systems.
		6.1.3.5	Prepare plans that ensure implementation of proper food storage procedures.
		6.1.3.6	Implement and evaluate the effectiveness of a documentation procedure used within a food products and processing facility and recommend improvements.
Topic 6.2	***Apply principles of nutrition, biology, microbiology, chemistry, and human behavior to the development of food products.***		
	Student Competencies		
	6.2.1	**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.**	
		6.2.1.1	Research and summarize properties of common food constituents (e.g., proteins, carbohydrates, fats, vitamins, minerals).
		6.2.1.2	Research and report methods of nutritional planning to meet essential needs for the human diet (e.g., MyPlate).
		6.2.1.3	Compare and contrast the relative value of food constituents relative to food product qualities (e.g., taste, appearance, etc.).
		6.2.1.4	Compare and contrast the nutritional needs of different human diets.
		6.2.1.5	Analyze the properties of food products to identify food constituents and evaluate nutritional value.
		6.2.1.6	Construct methods to design a healthy daily food guide for a variety of nutritional needs.
	6.2.2	**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.**	
		6.2.2.1	Examine and describe the basic chemical makeup of different types of food.

		6.2.2.2	Identify common food additives and identify their properties (e.g., preservatives, antioxidants, buffers, stabilizers, colors, flavors, etc.).
		6.2.2.3	Research and summarize the application of biochemistry in the development of new food products (e.g., value added food products, genetically engineered food products, etc.).
		6.2.2.4	Explain how the chemical and physical properties of foods influence nutritional value and eating quality.
		6.2.2.5	Describe the purpose of common food additives and how they influence the chemistry of food.
		6.2.2.6	Analyze how food products and processing facilities use biochemistry concepts to develop new food products.
		6.2.2.7	Design and conduct experiments to determine the chemical and physical properties of food products.
		6.2.2.8	Devise and apply strategies to determine what additives are utilized and why they are included in a variety of food products.
		6.2.2.9	Develop and implement plans to engineer new food items using biochemistry concepts.
	6.2.3	**APPLY PRINCIPLES OF HUMAN BEHAVIOR TO DEVELOP FOOD PRODUCTS TO PROVIDE A SAFE, WHOLESOME, AND NUTRITIOUS FOOD SUPPLY FOR LOCAL AND GLOBAL FOOD SYSTEMS.**	
		6.2.3.1	Examine and explain the importance of food labeling to the consumer.
		6.2.3.2	Research and summarize relevant factors in planning and developing a new food product (e.g., regulation, creativity, economics, etc.).
		6.2.3.3	Examine, interpret, and explain the meaning of required components on a food label.
		6.2.3.4	Determine consumer preference and market potential for a new food product using a variety of methods (e.g., double-blind testing, etc.).
		6.2.3.5	Determine a strategy to prepare and label foods according to the established standards of regulatory agencies.
		6.2.3.6	Design new food products that meet a variety of goals (e.g., consumer preferences, market, nutritional needs, regulatory requirements, etc.).
Topic 6.3	***Select and process food products for storage, distribution, and consumption.***		
	Student Competencies		
	6.3.1	**IMPLEMENT SELECTION, EVALUATION AND INSPECTION TECHNIQUES TO ENSURE SAFE AND QUALITY FOOD PRODUCTS.**	
		6.3.1.1	Summarize characteristics of quality and yield grades of food products.
		6.3.1.2	Summarize procedures to select raw food products based on yield grades and quality grades.
		6.3.1.3	Identify and describe protocols for inspection and harvesting techniques for animal food products (e.g., pre-mortem and post-mortem inspections, Food Safety Inspection Service guidelines (FSIS), etc.).
		6.3.1.4	Identify and describe foods derived from different classifications of food products (e.g., meat, egg, poultry, fish, dairy, fruits, vegetables, grains, legumes, oilseeds, etc.).

	6.3.1.5	Analyze factors that affect quality and yield grades of food products.
	6.3.1.6	Assemble procedures to perform quality-control inspections of raw food products for processing.
	6.3.1.7	Examine and evaluate inspection and harvesting of animals using regulatory agency approved or industry-approved techniques.
	6.3.1.8	Examine and summarize desirable qualities of food products derived from different classifications of food products.
	6.3.1.9	Outline procedures to assign quality and yield grades to food products according to industry standards.
	6.3.1.10	Develop, apply, and evaluate care and handling procedures to maintain original food quality and yield.
	6.3.1.11	Examine and respond to consumer concerns about the inspection and harvesting techniques of animals using accurate information based on regulatory agency approved or industry-approved techniques.
	6.3.1.12	Evaluate and grade food products from different classifications of food products.
6.3.2	**DESIGN AND APPLY TECHNIQUES OF FOOD PROCESSING, PRESERVATION, PACKAGING, AND PRESENTATION FOR DISTRIBUTION AND CONSUMPTION OF FOOD PRODUCTS.**	
	6.3.2.1	Identify and explain English and metric measurements used in the food products and processing industry.
	6.3.2.2	Differentiate between methods and materials used for processing food for different markets (e.g., fresh food products, ready to eat food products, etc.).
	6.3.2.3	Identify methods of food preservation and give examples of foods preserved by each method.
	6.3.2.4	Summarize types of materials and methods used in food packaging and presentation.
	6.3.2.5	Compare weights and measurements of products and perform conversions between units of measure.
	6.3.2.6	Outline appropriate methods and prepare foods for sale and distribution for different markets.
	6.3.2.7	Analyze and document food preservation processes and methods on a variety of food products.
	6.3.2.8	Analyze the degree of desirable food qualities of foods stored in various packaging.
	6.3.2.9	Design plans to formulate and package food products using a variety of weights and measures.
	6.3.2.10	Evaluate food quality factors on foods prepared for different markets (e.g., shelf life, shrinkage, appearance, weight, etc.).
	6.3.2.11	Devise and apply strategies to preserve different foods using various methods and techniques.
	6.3.2.12	Construct and implement methods of selecting packaging materials to store a variety of food products.
6.3.3	**CREATE FOOD DISTRIBUTION PLANS AND PROCEDURES TO ENSURE SAFE DELIVERY OF FOOD PRODUCTS.**	
	6.3.3.1	Assess and describe the environmental impact of distributing food locally and globally.
	6.3.3.2	Examine the various paths food products take to get from food processing centers to consumers.

	6.3.3.3	Research and summarize different types of market demands for food products (e.g., local food, organic, non-GMO, etc.).
	6.3.3.4	Research and document ways to reduce environmental impact from food distribution activities.
	6.3.3.5	Interpret safety procedures used in food distribution to ensure a safe product is being delivered to consumers.
	6.3.3.6	Assess and explain how market demand for food products influences the distribution of food products.
	6.3.3.7	Devise and defend a strategy to determine ways for food distribution to reduce environmental impacts.
	6.3.3.8	Make recommendations to improve safety procedures used in food distribution scenarios to ensure a safe product is being delivered to consumers.
	6.3.3.9	Propose distribution plans for food products that meet specific market demands.
Topic 6.4	***Explain the scope of the food industry and the historical and current developments of food product and processing.***	
	Student Competencies	
	6.4.1	**EXAMINE THE SCOPE OF THE FOOD INDUSTRY BY EVALUATING LOCAL AND GLOBAL POLICIES, TRENDS, AND CUSTOMS FOR FOOD PRODUCTION.**
	6.4.1.1	Research and summarize examples of policy and legislation that affect food products and processing systems in the United States and around the world (e.g., labeling, GMOs, biosecurity, food system policy, dietary guidelines, etc.).
	6.4.1.2	Examine the impact of consumer trends on food products and processing practices (e.g., health and nutrition, organic, information about food products, local food movements, farm-to-fork supply chains, food system transparency, etc.).
	6.4.1.3	Compare and contrast cultural differences regarding food products and processing practices.
	6.4.1.4	Analyze the similarities and differences amongst policies and legislation that affect the food products and processing system in the U.S. or around the world.
	6.4.1.5	Construct and implement methods to obtain data on food consumer trends in a specific market.
	6.4.1.6	Analyze food production and distribution outcomes based on cultural customs.
	6.4.1.7	Articulate and defend a personal point of view on policies and legislation that affect the food products and processing system in the U.S. or around the world.
	6.4.1.8	Devise and implement a strategy to create food products that meet a specific consumer trend in a specific market.
	6.4.1.9	Propose and implement culturally sensitive food processing and distribution practices.
	6.4.2	**EVALUATE THE SIGNIFICANCE AND IMPLICATIONS OF CHANGES AND TRENDS IN THE FOOD PRODUCTS AND PROCESSING INDUSTRY IN THE LOCAL AND GLOBAL FOOD SYSTEMS.**
	6.4.2.1	Describe and explain the components of the food products and processing industry (e.g., processing, distribution, byproducts, etc.).
	6.4.2.2	Identify and explain environmental and safety concerns about the food supply.

	6.4.2.3	Research and describe current and emerging technologies related to food products and processing (e.g., high pressure processing of foods, automation, biotechnology, etc.).
	6.4.2.4	Analyze & document significant changes & trends in the food products/processing industry.
	6.4.2.5	Research & summarize current issues related to the safety and environmental concerns about foods and food processing (e.g., GMOs, irradiation, microorganisms, contamination, etc.).
	6.4.2.6	Evaluate desirable and undesirable outcomes of emerging technologies used in the food products and processing systems.
	6.4.2.7	Predict & defend upcoming changes & trends in the food products and processing industry.
	6.4.2.8	Examine and respond to consumer concerns about the environment and safety of the food supply using accurate information regarding food products and processing systems and practices.
	6.4.2.9	Research and evaluate the feasibility of implementing a current or emerging technology to improve a current food product or process used in a facility.
6.4.3	**IDENTIFY AND EXPLAIN THE PURPOSE OF INDUSTRY ORGANIZATIONS, GROUPS, AND REGULATORY AGENCIES THAT INFLUENCE THE LOCAL AND GLOBAL FOOD SYSTEMS.**	
	6.4.3.1	Examine and summarize the purposes of organizations that influence or regulate the food products and processing industry.
	6.4.3.2	Examine and describe the importance and usage of regulatory oversight of food safety and security in food products and processing (e.g., internationally, nationally, state, and local).
	6.4.3.3	Evaluate the changes in the food products and processing industry brought about by industry organizations or regulatory agencies.
	6.4.3.4	Assess and summarize the application of industry standards in the food products and processing industry.
	6.4.3.5	Construct and implement methods to obtain data about organizations, groups, and regulatory agencies that affect the food products and processing industry.
	6.4.3.6	Construct and implement plans that ensure adherence to industry standards for food products and processing facilities.

Standard 7	NATURAL RESOURCE SYSTEMS		
Topic 7.1	***Plan and conduct natural resource management activities that apply logical, reasoned, and scientifically based solutions to natural resource issues and goals.***		
	Student Competencies		
	7.1.1	**APPLY METHODS OF CLASSIFICATION TO EXAMINE NATURAL RESOURCE AVAILABILITY AND ECOSYSTEM FUNCTION IN A PARTICULAR REGION.**	
		7.1.1.1	Summarize and classify the different kinds of natural resources using common classification schemes (e.g., living vs. non-living, renewable vs. nonrenewable, native vs. introduced, etc.).
		7.1.1.2	Summarize the components that comprise all ecosystems.
		7.1.1.3	Summarize and classify different kinds of living species based on evolutionary traits.
		7.1.1.4	Assess the characteristics of a natural resource to determine its classification.
		7.1.1.5	Analyze the interdependence of organisms within an ecosystem (e.g., food webs, niches, impact of keystone species, etc.) and assess the dependence of organisms on nonliving components (climate, geography, energy flow, nutrient cycling, etc.).
		7.1.1.6	Analyze how biodiversity develops through evolution, natural selection, and adaptation; explain the importance of biodiversity to ecosystem function and availability of natural resources.
		7.1.1.7	Devise strategies for the preservation of natural resources based on their classification.
		7.1.1.8	Conduct analyses of ecosystems and document the interactions of living species and non-living resources.
		7.1.1.9	Evaluate biodiversity in ecosystems and devise strategies to enhance the function of an ecosystem and the availability of natural resources by increasing the level of biodiversity.
	7.1.2	**CLASSIFY DIFFERENT TYPES OF NATURAL RESOURCES IN ORDER TO ENABLE PROTECTION, CONSERVATION, ENHANCEMENT, AND MANAGEMENT IN A PARTICULAR GEOGRAPHICAL REGION.**	
		7.1.2.1	Research and examine the characteristics used to identify trees and woody plants.
		7.1.2.2	Research and examine the characteristics used to identify herbaceous plants.
		7.1.2.3	Research and examine the characteristics used to identify wildlife and insects.
		7.1.2.4	Research and examine the characteristics used to identify aquatic species.
		7.1.2.5	Research and examine the characteristics used to identify non-living resources (e.g., soil types, climate, geography, etc.).
		7.1.2.6	Research the purpose and value of resource inventories and population studies.
		7.1.2.7	Apply identification techniques to determine the species of a tree or woody plant.
		7.1.2.8	Apply identification techniques to determine the species of an herbaceous plant.
		7.1.2.9	Apply identification techniques to determine the species of wildlife or insect.
		7.1.2.10	Apply identification techniques to determine the species of an aquatic organism.

	7.1.2.11	Apply identification techniques to determine the types of non-living resources in an area.
	7.1.2.12	Apply procedures for conducting resource inventories and population studies.
	7.1.2.13	Evaluate the species of trees present to assess the health of an ecosystem (e.g., presence of native vs. invasive species, biodiversity, etc.).
	7.1.2.14	Evaluate the species of herbaceous plants present to assess the health of an ecosystem (e.g., presence of native vs. invasive plants, biodiversity, etc.).
	7.1.2.15	Evaluate the species of wildlife and insects present to assess the health of an ecosystem.
	7.1.2.16	Evaluate the aquatic species present to assess the health of an ecosystem.
	7.1.2.17	Evaluate the non-living resources present in an area to determine the best practices for improving, enhancing, and protecting an ecosystem.
	7.1.2.18	Conduct an assessment of the resource inventories or population in a given area.
7.1.3	**APPLY ECOLOGICAL CONCEPTS AND PRINCIPLES TO ATMOSPHERIC NATURAL RESOURCE SYSTEMS.**	
	7.1.3.1	Classify different kinds of biogeochemical cycles and the role they play in natural resources systems.
	7.1.3.2	Research and summarize how climate factors influence natural resource systems.
	7.1.3.3	Assess the role that the atmosphere plays in the regulation of biogeochemical cycles.
	7.1.3.4	Analyze the impact that climate has on natural resources and debate how this impact has changed due to human activity.
	7.1.3.5	Evaluate and make recommendations to lessen the impact of human activity on the ability of the atmosphere to regulate biogeochemical cycles.
	7.1.3.6	Assess the primary causes of climate change and design strategies to lessen its impact on natural resource systems.
7.1.4	**APPLY ECOLOGICAL CONCEPTS AND PRINCIPLES TO AQUATIC NATURAL RESOURCE SYSTEMS.**	
	7.1.4.1	Summarize the roles and properties of watersheds.
	7.1.4.2	Examine and describe the importance of groundwater and surface water to natural resources.
	7.1.4.3	Compare and contrast riparian zones and riparian buffers based on their function.
	7.1.4.4	Assess the function of watersheds and their effect on natural resources.
	7.1.4.5	Analyze how different classifications of ground and surface water affect ecosystem function.
	7.1.4.6	Assess techniques used in the creation, enhancement, and management of riparian zones and riparian buffers.
	7.1.4.7	Evaluate and defend the importance of watersheds to ecosystem function.
	7.1.4.8	Devise and apply strategies to manage, protect, enhance, or improve sources of groundwater or surface water based on its properties.
	7.1.4.9	Devise and apply strategies for the creation, enhancement, and management of riparian zones and riparian buffers.

7.1.5	**APPLY ECOLOGICAL CONCEPTS AND PRINCIPLES TO TERRESTRIAL NATURAL RESOURCE SYSTEMS.**	
	7.1.5.1	Research and describe the stages of ecological succession.
	7.1.5.2	Compare and contrast the impact of habitat disturbances and habitat resilience.
	7.1.5.3	Compare and contrast techniques associated with sustainable forestry (e.g., timber stand improvement, diversity improvement, reforestation, etc.).
	7.1.5.4	Compare and contrast techniques associated with soil management (e.g., soil survey and interpretation, erosion control, etc.).
	7.1.5.5	Analyze and summarize examples of stages of succession.
	7.1.5.6	Analyze and summarize examples of habitat disturbances and habitat resilience.
	7.1.5.7	Analyze a forest in order to determine which forestry techniques would improve that habitat.
	7.1.5.8	Analyze a plot of land in order to determine which soil management techniques would be most applicable.
	7.1.5.9	Evaluate the stages of succession present in an ecosystem and predict which species will become more prevalent through future stages of succession.
	7.1.5.10	Interpret signs of habitat disturbances and resilience in an ecosystem and use these signs to assess the health of an ecosystem.
	7.1.5.11	Devise a forest management plan that improves the habitat while sustainably maximizing the amount of timber that can be harvested.
	7.1.5.12	Devise a soil management plan to minimize erosion and maximize biodiversity, plant productivity, and the formation of topsoil.
7.1.6	**APPLY ECOLOGICAL CONCEPTS AND PRINCIPLES TO LIVING ORGANISMS IN NATURAL RESOURCE SYSTEMS.**	
	7.1.6.1	Differentiate between population ecology, population density, and population dispersion and describe the importance of these concepts to natural resource systems.
	7.1.6.2	Research and summarize examples of invasive species.
	7.1.6.3	Analyze the factors that influence population density and population dispersion in natural resource systems.
	7.1.6.4	Analyze factors that influence the establishment and spread of invasive species and determine the appropriate steps to prevent or minimize the impact of invasive species.
	7.1.6.5	Create a management plan for a population of a species in an ecosystem given its population ecology, population density and population dispersion in natural resource systems.
	7.1.6.6	Evaluate the presence and impact of invasive species on natural resources in a given area and devise a plan to prevent, control, or eliminate invasive species from that habitat.

Topic 7.2	*Analyze the interrelationships between natural resources and humans.*	
	Student Competencies	
	7.2.1	**EXAMINE & INTERPRET THE PURPOSE, ENFORCEMENT, IMPACT, & EFFECTIVENESS OF LAWS & AGENCIES RELATED TO NATURAL RESOURCE MANAGEMENT, PROTECTION, ENHANCEMENT, & IMPROVEMENT (E.G., WATER REGULATIONS, GAME LAWS, HISTORIC PRESERVATION LAWS, ENVIRONMENTAL POLICY, ETC.).**
	7.2.1.1	Distinguish between the types of laws associated with natural resources systems.
	7.2.1.2	Distinguish between the types of agencies associated with natural resources systems.
	7.2.1.3	Analyze the structure of laws associated with natural resources systems.
	7.2.1.4	Analyze the specific purpose of agencies associated with natural resources systems.
	7.2.1.5	Evaluate the impact of laws associated with natural resources systems (e.g., mitigation, water regulations, carbon emissions, game limits, invasive species, etc.).
	7.2.1.6	Evaluate the impact and effectiveness of agencies associated with natural resources systems (e.g., regulation of consumption, prevention of damage to natural resources systems, management of ecological interactions, etc.).
	7.2.2	**ASSESS THE IMPACT OF HUMAN ACTIVITIES ON THE AVAILABILITY OF NATURAL RESOURCES.**
	7.2.2.1	Summarize the relationship between natural resources, ecosystems, and human activity.
	7.2.2.2	Categorize the primary causes of extinction of living species due to human activity (e.g., overharvesting, habitat loss, invasive species, pollution, etc.).
	7.2.2.3	Examine and describe the manner in which modern lifestyles are related to the depletion of natural resources.
	7.2.2.4	Assess and explain how different kinds of human activity affect the use and availability of natural resources (i.e., agriculture, industry, transportation, etc.).
	7.2.2.5	Assess causes of extinction and describe how those causes related to loss of biodiversity.
	7.2.2.6	Identify solutions to improve the sustainability of modern lifestyles.
	7.2.2.7	Evaluate how the availability of natural resources can be improved through changes to human activity.
	7.2.2.8	Devise a strategy for preventing the loss of species and biodiversity that takes into account the primary causes of species extinction from human activity.
	7.2.2.9	Evaluate how modern lifestyles affect resource consumption and energy use and devise a strategy to prevent the complete loss of a natural resource.
	7.2.3	**ANALYZE HOW MODERN PERCEPTIONS OF NATURAL RESOURCE MANAGEMENT, PROTECTION, ENHANCEMENT, & IMPROVEMENT CHANGE & DEVELOP OVER TIME.**
	7.2.3.1	Summarize and categorize the different social considerations in regards to the use of natural resources (e.g., public vs. private, laws and regulations, economics, green technology, etc.).

	7.2.3.2	Research and assess how historical figures played a prominent role in shaping how natural resources are viewed and used today (e.g., Aldo Leopold, Teddy Roosevelt, John Muir, Rachel Carson, Gaylord Nelson, etc.).
	7.2.3.3	Research how technology has affected the use and views of natural resources.
	7.2.3.4	Analyze how social considerations can affect the use and sustainability of natural resources.
	7.2.3.5	Examine and describe the relationship between current trends in natural resource systems and historical figures that played a prominent role in shaping how natural resources are viewed and used today.
	7.2.3.6	Analyze & document how some technological advancements changed how natural resources were used and viewed (e.g., Industrial Revolution, fossil fuels, green technology, etc.).
	7.2.3.7	Develop predictions for how the management, protection, enhancement and improvement of natural resources will evolve through social considerations (e.g., establishment of national parks, public opinion and fishing, reduction of waste and energy consumption, etc.).
	7.2.3.8	Anticipate and predict how society's views and use of natural resources will continue to change as a result of historical figures and trends in modern society.
	7.2.3.9	Anticipate and predict how future technological advancements may affect the use and views of natural resources.
7.2.4	**EXAMINE AND EXPLAIN HOW ECONOMICS AFFECTS THE USE OF NATURAL RESOURCES.**	
	7.2.4.1	Compare and contrast how the economic value of a natural resource affects its availability.
	7.2.4.2	Research the impact of the use of natural resources on local, state and national economies (e.g., outdoor recreation, energy production, preservation, etc.).
	7.2.4.3	Compare and contrast the economic impact of green technology and alternative energy.
	7.2.4.4	Assess whether economic value increases or decreases the conservation, protection, improvement, and enhancement of natural resources.
	7.2.4.5	Assess the importance of the use of natural resources on local, state, and national economies.
	7.2.4.6	Analyze and document how the adoption of green technology and/or alternative energy affected a local, state, or national economy.
	7.2.4.7	Devise a plan to improve the conservation, protection, improvement, and enhancement of natural resources based on economic value and practices.
	7.2.4.8	Anticipate and predict how changes to the availability of natural resources because of human activity may impact a local, state, and national economy.
	7.2.4.9	Anticipate and predict the economic impact green technology and alternative energy.
7.2.5	**COMMUNICATE INFORMATION TO THE PUBLIC REGARDING TOPICS RELATED TO THE MANAGEMENT, PROTECTION, ENHANCEMENT, AND IMPROVEMENT OF NATURAL RESOURCES.**	
	7.2.5.1	Examine and describe ways in which a message regarding natural resources may be communicated to the public through standard media sources (e.g., press, radio, TV, public appearances, etc.).

	7.2.5.2	Research and summarize how social media and the Internet have changed how people perceive and utilize natural resources (e.g., greater awareness of conservation issues, calls to action, etc.).
	7.2.5.3	Examine and describe how communication can be used to influence behavior, call people to action, and instill a sense of civic behavior related to the conservation, management, enhancement, and improvement of natural resources.
	7.2.5.4	Assess the effectiveness of different methods for communicating natural resource messages.
	7.2.5.5	Assess how to most effectively communicate a message about the conservation, management, enhancement, and improvement of natural resources via social media and the Internet.
	7.2.5.6	Analyze and summarize examples of how communication can be used to influence behavior, call people to action, and instill a sense of civic behavior related to the conservation, management, enhancement, and improvement of natural resources.
	7.2.5.7	Devise and implement a strategy for communicating a natural resources message through media.
	7.2.5.8	Anticipate and predict how messages about the conservation, management, enhancement, and improvement of natural resources will change because of social media and the Internet.
	7.2.5.9	Create a communication plan to influence the behavior of people, call people to action, and instill a sense of civic behavior related to the conservation, management, enhancement, and improvement of natural resources.
Topic 7.3	***Develop plans to ensure sustainable production and processing of natural resources.***	
	Student Competencies	
7.3.1	**SUSTAINABLY PRODUCE, HARVEST, PROCESS, AND USE NATURAL RESOURCE PRODUCTS (E.G., FOREST PRODUCTS, WILDLIFE, MINERALS, FOSSIL FUELS, SHALE OIL, ALTERNATIVE ENERGY, RECREATION, AQUATIC SPECIES, ETC.).**	
	7.3.1.1	Summarize forest harvesting methods.
	7.3.1.2	Research and describe methods by which wildlife can be sustainably harvested (e.g., controlled harvests, hunting licenses, regulations, etc.).
	7.3.1.3	Compare and contrast the costs and benefits (e.g., impacts on environment, economic, wildlife, etc.) of mineral extraction to a local, state, and/or national economy.
	7.3.1.4	Compare and contrast the costs and benefits (e.g., impacts on environment, economic, wildlife, etc.) of fossil fuels to a local, state, and/or national economy.
	7.3.1.5	Compare and contrast the costs and benefits (e.g., environmental impacts, etc.) of shale oil from fracking to a local, state, and/or national economy.
	7.3.1.6	Compare and contrast the costs and benefits (e.g., environmental impacts, etc.) of alternative sources of energy (e.g., hydroelectric, solar, wind, biofuels, geothermal, etc.).
	7.3.1.7	Research and summarize how recreational uses of natural resources can be changed to improve sustainability.
	7.3.1.8	Categorize aquatic species used for commercial and recreational purposes.

	7.3.1.9	Assess harvesting methods in regards to their economic value, environmental impact, and other factors.
	7.3.1.10	Assess and apply techniques used to harvest wildlife in regards to sustainability, practicality, and other factors.
	7.3.1.11	Assess the economic impact of mineral extraction in regards to the costs and benefits to a local, state, and/or national economy.
	7.3.1.12	Assess the economic impact of fossil fuel extraction in regards to the costs and benefits to a local, state, and/or national economy.
	7.3.1.13	Assess the economic impact of shale oil extraction (i.e., fracking) in regards to the costs and benefits to a local, state, and/or national economy.
	7.3.1.14	Assess and evaluate factors that affect the economic, environmental, and social sustainability in regards to the use of alternative sources of energy.
	7.3.1.15	Assess different options for improving the sustainability of outdoor recreation based on its impact on natural resources and likelihood of acceptance.
	7.3.1.16	Analyze and apply techniques used to acquire aquatic species for their environmental, economic, and social sustainability.
	7.3.1.17	Develop a forest harvesting plan that ensures economic, environmental, and social sustainability.
	7.3.1.18	Develop a method for the sustainable harvest of wildlife species.
	7.3.1.19	Evaluate methods used to extract and process minerals for economic, environmental, and social sustainability.
	7.3.1.20	Evaluate methods used to extract and process fossil fuels for economic, environmental, and social sustainability.
	7.3.1.21	Evaluate methods used to extract and process shale oil for economic, environmental, and social sustainability.
	7.3.1.22	Assess trends in energy production and consumption in order to predict how the impact of alternative energy will change in the future.
	7.3.1.23	Evaluate an example of outdoor recreation and develop suggestions for how that activity can be made more sustainable in a manner that is acceptable to those who take part in that activity.
	7.3.1.24	Develop recommendations for the sustainable harvest of aquatic species.
7.3.2	**DEMONSTRATE CARTOGRAPHIC SKILLS, TOOLS, AND TECHNOLOGIES TO AID IN DEVELOPING, IMPLEMENTING, AND EVALUATING NATURAL RESOURCE MANAGEMENT PLANS.**	
	7.3.2.1	Summarize how to use maps and technologies to identify directions and land features, calculate actual distance, and determine the elevations of points.
	7.3.2.2	Summarize how GIS can be used to manage, conserve, improve, and enhance the natural resources of an area.

	7.3.2.3	Apply cartographic skills and tools and technologies (e.g., land surveys, geographic coordinate systems, etc.) to locate natural resources.
	7.3.2.4	Analyze an area's resources using GIS technologies.
	7.3.2.5	Evaluate the availability of and threats to natural resources using cartographic skills, tools, and technologies (e.g., spread of invasive species, movement of wildlife populations, changes to biodiversity of edge of habitat versus interior, etc.).
	7.3.2.6	Use GIS data for a given area to devise a management plan for the management, conservation, improvement, and enhancement of its natural resources.
Topic 7.4	***Use GIS data for a given area to devise a management plan for the management, conservation, improvement, and enhancement of its natural resources.***	
	Student Competencies	
	7.4.1	**DEMONSTRATE NATURAL RESOURCE PROTECTION, MAINTENANCE, ENHANCEMENT, AND IMPROVEMENT TECHNIQUES.**
	7.4.1.1	Identify and categorize different kinds of streams.
	7.4.1.2	Identify and categorize characteristics of a healthy forest.
	7.4.1.3	Identify and categorize characteristics of a healthy wildlife habitat.
	7.4.1.4	Identify and categorize characteristics of healthy rangeland.
	7.4.1.5	Identify and categorize characteristics of natural resources that make them desirable for recreational purposes.
	7.4.1.6	Identify and categorize characteristics of healthy marine and coastal natural resources.
	7.4.1.7	Assess and explain indicators of the biological health of a stream.
	7.4.1.8	Assess and apply the methods used to improve a forest stand.
	7.4.1.9	Assess and apply methods of wildlife habitat improvement.
	7.4.1.10	Assess and apply methods of rangeland improvement.
	7.4.1.11	Assess and apply management techniques for improving outdoor recreation opportunities.
	7.4.1.12	Assess and apply methods to improve marine and coastal natural resources.
	7.4.1.13	Create an enhancement plan for a stream.
	7.4.1.14	Create a timber stand improvement plan for a forest.
	7.4.1.15	Devise a comprehensive improvement plan for a wildlife habitat.
	7.4.1.16	Evaluate and revise a rangeland management plan.
	7.4.1.17	Evaluate the impact of recreational activities on natural resources and create an improvement plan.
	7.4.1.18	Create an improvement plan for marine or coastal natural resources.
	7.4.2	**DIAGNOSE PLANT AND WILDLIFE DISEASES AND FOLLOW PROTOCOLS TO PREVENT THEIR SPREAD.**
	7.4.2.1	Classify causes of diseases in plants and the correct authorities to whom some diseases should be reported.

	7.4.2.2	Classify causes of diseases in wildlife and aquatic species and determine the correct authorities to whom some diseases should be reported.
	7.4.2.3	Analyze a plant disease based on its symptoms, identify if the disease needs to be reported to authorities, and determine to which authorities it should be reported.
	7.4.2.4	Analyze a wildlife or aquatic species disease based on its symptoms, identify if the disease needs to be reported to authorities, and determine to which authorities it should be reported.
	7.4.2.5	Create a management plan to reduce infection and the spread of plant diseases in natural resource systems.
	7.4.2.6	Create a management plan to reduce infection and spread of wildlife or aquatic species diseases in natural resource systems.
7.4.3	**PREVENT OR MANAGE INTRODUCTION OF ECOLOGICALLY HARMFUL SPECIES IN A PARTICULAR REGION.**	
	7.4.3.1	Categorize harmful and beneficial insects, as well as signs of insect damage to natural resources.
	7.4.3.2	Identify and classify invasive species common to a particular region.
	7.4.3.3	Research and summarize strategies and benefits of preventing the introduction of harmful species to a particular region.
	7.4.3.4	Analyze signs of insect infestation, identify if it needs to be reported to authorities, and determine to which authorities it should be reported.
	7.4.3.5	Analyze signs of the spread of invasive species, identify if it needs to be reported to authorities, and determine to which authorities it should be reported.
	7.4.3.6	Assess and implement a plan for preventing the spread of harmful species for its effectiveness.
	7.4.3.7	Create a management plan to reduce spread of harmful insects in natural resource systems.
	7.4.3.8	Create a management plan to reduce spread of harmful invasive species in natural resource systems.
	7.4.3.9	Identify potentially invasive species and devise strategies to prevent ecological damage that would result from the introduction of that species.
7.4.4	**MANAGE FIRES IN NATURAL RESOURCE SYSTEMS.**	
	7.4.4.1	Differentiate between desirable and undesirable fires and research the role fire plays in a healthy ecosystem.
	7.4.4.2	Research and summarize how fire management techniques have evolved.
	7.4.4.3	Assess and apply techniques used to fight wildfires, manage prescribed fires, and ensure human safety.
	7.4.4.4	Assess the effectiveness of techniques previously & currently used to prevent harmful fires.
	7.4.4.5	Develop a prevention plan for harmful fires for a particular region.
	7.4.4.6	Anticipate and predict how fire management techniques will evolve in the future.

Standard 8	PLANT SYSTEMS		
Topic 8.1	***Develop and implement a crop management plan for a given production goal that accounts for environmental factors.***		
	Student Competencies		
	8.1.1	**DETERMINE THE INFLUENCE OF ENVIRONMENTAL FACTORS ON PLANT GROWTH.**	
		8.1.1.1	Identify and summarize the three measurements of light – color, intensity, and duration – that affect plant growth.
		8.1.1.2	Identify and summarize the effects of air and temperature on plant metabolism and growth.
		8.1.1.3	Identify and summarize the effects of water quality on plant growth (e.g., pH, dissolved solids, etc.).
		8.1.1.4	Analyze and describe plant responses to light color, intensity, and duration.
		8.1.1.5	Determine the optimal air and temperature conditions for plant growth.
		8.1.1.6	Analyze and describe plant responses to water conditions.
		8.1.1.7	Analyze plant responses to varied light color, intensity, and duration and recommend modifications to light for desired plant growth.
		8.1.1.8	Design, implement, and evaluate a plan to maintain optimal air and temperature conditions for plant growth.
		8.1.1.9	Analyze plant responses to water conditions and recommend modifications to water for desired plant growth.
	8.1.2	**PREPARE AND MANAGE GROWING MEDIA FOR USE IN PLANT SYSTEMS.**	
		8.1.2.1	Identify the major components of growing media and describe how growing media support plant growth.
		8.1.2.2	Identify the categories of soil water.
		8.1.2.3	Describe the physical and chemical characteristics of growing media and explain the influence they have on plant growth.
		8.1.2.4	Discuss how soil drainage and water-holding capacity can be improved.
		8.1.2.5	Formulate and prepare growing media for specific plants or crops.
		8.1.2.6	Determine the hydraulic conductivity for soil and how the results influence irrigation practices.
	8.1.3	**DEVELOP AND IMPLEMENT A FERTILIZATION PLAN FOR SPECIFIC PLANTS OR CROPS.**	
		8.1.3.1	Identify the essential nutrients for plant growth and development and their major functions (e.g., nitrogen, phosphorous, potassium, etc.).
		8.1.3.2	Discuss the influence of pH and cation exchange capacity on the availability of nutrients.
		8.1.3.3	Collect soil and plant tissue samples using generally accepted procedures and explain how incorrect sample collection will affect the results of a laboratory analysis.
		8.1.3.4	Identify fertilizer sources of essential plant nutrients; explain fertilizer formulations, including organic and inorganic; and describe different methods of fertilizer application.

		8.1.3.5	Research and summarize production methods focused on soil management (e.g., crop rotation, companion planting, cover crops, etc.).
		8.1.3.6	Summarize the impact of environmental factors on nutrient availability (e.g., moisture, temperature, pH, etc.).
		8.1.3.7	Analyze the effects of nutrient deficiencies and symptoms and recognize environmental causes of nutrient deficiencies.
		8.1.3.8	Contrast pH and cation exchange capacity between mineral soil and soilless growing media.
		8.1.3.9	Interpret laboratory analyses of soil and tissue samples.
		8.1.3.10	Calculate the amount of fertilizer to be applied based on nutrient recommendation and fertilizer analysis.
		8.1.3.11	Assess and describe the shorthand long-term effects production methods have on soil.
		8.1.3.12	Assess and describe the impact environmental factors have on a crop.
		8.1.3.13	Monitor plants for signs of nutrient deficiencies and prepare a scouting report to correct elements negatively affecting plant growth in a field or greenhouse.
		8.1.3.14	Adjust the pH of growing media for specific plants or crops.
		8.1.3.15	Prescribe fertilizer applications based on the results of a laboratory analysis of soil and plant tissue samples.
		8.1.3.16	Calibrate application equipment to meet plant nutrient needs.
		8.1.3.17	Devise a plan for soil management for a selected production method.
		8.1.3.18	Devise a plan to meet plant nutrient needs based on environmental factors present.
Topic 8.2	***Apply principles of classification, plant anatomy, and plant physiology to plant production and management.***		
	Student Competencies		
	8.2.1	**CLASSIFY PLANTS ACCORDING TO TAXONOMIC SYSTEMS.**	
		8.2.1.1	Identify and summarize systems used to classify plants based on specific characteristics.
		8.2.1.2	Describe the morphological characteristics used to identify agricultural and herbaceous plants (e.g., life cycles, growth habit, plant use and as monocotyledons or dicotyledons, woody, herbaceous, etc.).
		8.2.1.3	Compare and contrast the hierarchical classification of agricultural and ornamental plants.
		8.2.1.4	Identify and describe important plants to agricultural and ornamental plant systems by common names.
		8.2.1.5	Classify agricultural and ornamental plants according to the hierarchical classification system.
		8.2.1.6	Identify and describe important plants to agricultural and ornamental plant systems by scientific names.
	8.2.2	**APPLY KNOWLEDGE OF PLANT ANATOMY AND THE FUNCTIONS OF PLANT STRUCTURES TO ACTIVITIES ASSOCIATED WITH PLANT SYSTEMS.**	
		8.2.2.1	Identify structures in a typical plant cell and summarize the function of plant cell organelles.
		8.2.2.2	Identify and summarize the components, the types, and the functions of plant roots.
		8.2.2.3	Identify and summarize the components and the functions of plant stems.

	8.2.2.4	Research and summarize leaf morphology and the functions of leaves.
	8.2.2.5	Identify and summarize the components of a flower, the functions of a flower, and the functions of flower components.
	8.2.2.6	Identify and summarize the functions and components of seeds and fruit.
	8.2.2.7	Compare and contrast mitosis and meiosis.
	8.2.2.8	Analyze root tissues and explain the pathway of water and nutrients into and through root tissues.
	8.2.2.9	Analyze and describe the difference in arrangement of vascular tissue between monocot and dicot plant stems.
	8.2.2.10	Analyze how leaves capture light energy and summarize the exchange of gases.
	8.2.2.11	Apply knowledge of flower structure to differentiate between the types of flowers and flower inflorescence (e.g., complete, incomplete, perfect, imperfect).
	8.2.2.12	Analyze and categorize the major types of seeds and fruit.
	8.2.2.13	Apply the knowledge of cell differentiation and the functions of the major types of cells to plant systems.
	8.2.2.14	Correlate the active and passive transport of minerals into and through the root system to plant nutrition.
	8.2.2.15	Evaluate the function of the xylem, phloem, and cambium tissues and the impact on plant systems.
	8.2.2.16	Devise a plan for plant management practices that takes into account leaf structure and functions.
	8.2.2.17	Evaluate flower structures and analyze the impact of plant structure on plant breeding, production, and use.
	8.2.2.18	Evaluate the impact of different seed and fruit structures to plant culture and use.
8.2.3	**APPLY KNOWLEDGE OF PLANT PHYSIOLOGY AND ENERGY CONVERSION TO PLANT SYSTEMS.**	
	8.2.3.1	Summarize the importance of photosynthesis to plant life on earth and the process of photosynthesis, including the types (c3, c4, Cam), its stages (e.g., light-dependent and light independent reactions), and its products and byproducts.
	8.2.3.2	Summarize the stages of cellular respiration including their products and byproducts.
	8.2.3.3	Summarize primary growth and the role of the apical meristem.
	8.2.3.4	Identify and categorize the five groups of naturally occurring plant hormones and synthetic plant growth regulators.
	8.2.3.5	Compare and contrast the effects of transpiration, translocation and assimilation on plants.
	8.2.3.6	Apply knowledge of photosynthesis to analyze how various environmental factors will affect the rate of photosynthesis.
	8.2.3.7	Analyze the factors that affect cellular respiration processes and rate in a crop production setting.
	8.2.3.8	Analyze plant growth and assess the process of secondary plant growth.
	8.2.3.9	Analyze and identify the plant responses to plant growth regulators and different forms of tropism.
	8.2.3.10	Identify and analyze the factors affecting transpiration, translocation, and assimilation rate and products.

		8.2.3.11	Evaluate the impact of photosynthesis and the factors that affect it on plant management, culture, and production problems.
		8.2.3.12	Evaluate the impact of plant respiration on plant growth, crop management, and post-harvest handling decisions.
		8.2.3.13	Relate the principles of primary and secondary growth to plant systems.
		8.2.3.14	Select and defend the use of specific plant growth regulators to produce desired responses from plants.
		8.2.3.15	Devise plans for plant management that applies knowledge of transpiration, translocation, and assimilation on plant growth.
Topic 8.3	***Propagate, culture, and harvest plants and plant products based on current industry standards.***		
	Student Competencies		
	8.3.1	**DEMONSTRATE PLANT PROPAGATION TECHNIQUES IN PLANT SYSTEM ACTIVITIES.**	
		8.3.1.1	Identify examples of and summarize pollination, cross-pollination, and self-pollination of flowering plants.
		8.3.1.2	Demonstrate sowing techniques for providing favorable conditions to meet the factors of seed germination.
		8.3.1.3	Summarize optimal conditions for asexual propagation and demonstrate techniques used to propagate plants by cuttings, division, separation, layering, budding, and grafting.
		8.3.1.4	Define micropropagation, discuss advantages associated with the practice, and summarize the main stages of the process.
		8.3.1.5	Summarize the principles of recombinant DNA technology and the basic steps in the process.
		8.3.1.6	Examine and apply the process of plant pollination and/or fertilization.
		8.3.1.7	Handle seed to overcome seed dormancy mechanisms and to maintain seed viability and vigor.
		8.3.1.8	Manage the plant environment to support asexual reproduction.
		8.3.1.9	Demonstrate aseptic micropropagation techniques.
		8.3.1.10	Compare and contrast the potential risks and advantages associated with genetically modified plants.
		8.3.1.11	Select and defend the use of pollination methods and practices used to maximize crop pollination.
		8.3.1.12	Conduct tests associated with seed germination rates, viability, and vigor.
		8.3.1.13	Evaluate asexual propagation practices based on productivity and efficiency.
		8.3.1.14	Propagate plants by micropropagation.
		8.3.1.15	Evaluate the impact of using genetically modified crops on other production practices.
	8.3.2	**DEVELOP AND IMPLEMENT A MANAGEMENT PLAN FOR PLANT PRODUCTION.**	
		8.3.2.1	Research and summarize the importance of starting with pest- and disease-free propagation material.
		8.3.2.2	List and summarize the reasons for preparing growing media before planting.
		8.3.2.3	Determine seeding rate need for specified plant population or desired quantity of finished plants.

	8.3.2.4	Observe and record environmental conditions during the germination, growth, and development of a crop.
	8.3.2.5	Summarize the stages of plant growth and the reasons for controlling plant growth.
	8.3.2.6	Identify and categorize structures and technologies used for controlled atmosphere production of plants.
	8.3.2.7	Summarize the use of hydroponic and aquaponic systems for plant production.
	8.3.2.8	Inspect propagation material for evidence of pests or disease.
	8.3.2.9	Prepare soil and growing media for planting with the addition of amendments.
	8.3.2.10	Apply pre-plant treatments required of seeds and plants and evaluate the results.
	8.3.2.11	Monitor the progress of plantings and determine the need to adjust environmental conditions.
	8.3.2.12	Demonstrate proper techniques to control and manage plant growth through mechanical, cultural, or chemical means.
	8.3.2.13	Compare and contrast the types of technologies used for controlled atmosphere production.
	8.3.2.14	Compare and contrast the types of systems used in hydroponic and aquaponic plant production.
	8.3.2.15	Produce pest- and disease-free propagation material.
	8.3.2.16	Analyze how mechanical planting equipment performs soil preparation and seed placement.
	8.3.2.17	Adjust and calibrate mechanized seeding and/or planting equipment for desired seed application rate.
	8.3.2.18	Prepare and implement a plant production schedule based on predicted environmental conditions and desired market target (e.g., having plants ready to market on a specific day such as Mother's Day, organic production, low maintenance landscape plants, etc.).
	8.3.2.19	Prepare plant production schedules utilizing plant growth knowledge to get plants to their optimal growth stage at a given time.
	8.3.2.20	Research, select, and defend technology for use in controlled atmosphere production.
	8.3.2.21	Research, select, and defend the use of a hydroponic or aquaponic plant system.
8.3.3	**DEVELOP AND IMPLEMENT A PLAN FOR INTEGRATED PEST MANAGEMENT FOR PLANT PRODUCTION.**	
	8.3.3.1	Identify and categorize plant pests, diseases, and disorders.
	8.3.3.2	Diagram the life cycle of major plant pests and diseases.
	8.3.3.3	Identify and summarize pest control strategies associated with integrated pest management and the importance of determining economic threshold.
	8.3.3.4	Distinguish between risks and benefits associated with the materials and methods used in plant pest management.
	8.3.3.5	Identify and analyze major local weeds, insect pests, and infectious and noninfectious plant diseases.
	8.3.3.6	Predict pest and disease problems based on environmental conditions and life cycles.
	8.3.3.7	Demonstrate pesticide formulations including organic and synthetic active ingredients and selection of pesticide to control specific pest.
	8.3.3.8	Examine and apply procedures for the safe handling, use, and storage of pesticides including personal protective equipment and reentry interval.

	8.3.3.9	Devise solutions for plant pests, diseases, and disorders.
	8.3.3.10	Design and implement a crop scouting program.
	8.3.3.11	Employ pest management strategies to manage pest populations, assess the effectiveness of the plan and adjust the plan as needed.
	8.3.3.12	Evaluate environmental and consumer concerns regarding pest management strategies.
8.3.4	**APPLY PRINCIPLES AND PRACTICES OF SUSTAINABLE AGRICULTURE TO PLANT PRODUCTION.**	
	8.3.4.1	Compare and contrast the alignment of different production systems (conventional and organic) with USDA sustainable practices criteria.
	8.3.4.2	Summarize national/international and local/regional food production systems.
	8.3.4.3	Identify and summarize impacts of environmental conditions on plants.
	8.3.4.4	Analyze the alignment of modern technologies used in production systems (e.g., precision agriculture, GE crops, etc.) with USDA sustainable practices criteria.
	8.3.4.5	Compare and contrast the impact on greenhouse gas, carbon footprint of the national/international production system with local/regional production system markets.
	8.3.4.6	Compare and contrast differing research conclusions related to environmental factors and their effect on plants.
	8.3.4.7	Research, prepare, and defend plans for a plant systems enterprise that aligns with USDA sustainable practices criteria.
	8.3.4.8	Select and defend the use of nationally/internationally grown or locally/ regionally grown for a production operation system.
	8.3.4.9	Evaluate evidence supporting claims on how environmental conditions effect plants.
8.3.5	**HARVEST, HANDLE, AND STORE CROPS ACCORDING TO CURRENT INDUSTRY STANDARDS.**	
	8.3.5.1	Identify and summarize harvesting methods and equipment.
	8.3.5.2	Research and summarize reasons for calculating crop loss and or damage.
	8.3.5.3	Research and summarize how safety is ensured at each stage of the following processes: harvesting, processing, and storing.
	8.3.5.4	Identify and categorize plant preparation methods for storing and shipping plants and plant products.
	8.3.5.5	Summarize the reasons for preparing plants and plant products for distribution.
	8.3.5.6	Assess the stage of growth to determine crop maturity or marketability and demonstrate proper harvesting techniques.
	8.3.5.7	Evaluate crop yield and loss data and make recommendations to reduce crop loss.
	8.3.5.8	Research and analyze practices used to maintain a safe product through harvest, processing, storage, and shipment (e.g., Food Safety Modernization Act, Good Agricultural Practices, etc.).
	8.3.5.9	Analyze the proper conditions required to maintain the quality of plants and plant products held in storage and during shipping.

		8.3.5.10	Demonstrate techniques for grading, handling, and packaging plants and plant products for distribution.
		8.3.5.11	Analyze the processed used by mechanical harvesting equipment.
		8.3.5.12	Implement and evaluate the effectiveness of plans to reduce crop loss.
		8.3.5.13	Research laws and apply regulations to ensure the production of plants and plant products that are safe for distribution and use.
		8.3.5.14	Monitor and evaluate environmental conditions in storage facilities for plants and plant products.
		8.3.5.15	Evaluate techniques for grading, handling, and packaging plants and plant products.
Topic 8.4	***Apply principles of design in plant systems to enhance an environment (e.g. floral, forest landscape, and farm).***		
	Student Competencies		
	8.4.1	**EVALUATING, IDENTIFYING, AND PREPARING PLANTS TO ENHANCE AN ENVIRONMENT.**	
		8.4.1.1	Identify and categorize plants by their purpose (e.g., floral plants, landscape plants, house plants, etc.).
		8.4.1.2	Summarize the applications of design in agriculture and ornamental plant systems.
		8.4.1.3	Demonstrate proper use of plants in their environment (e.g., focal and filler plants in floriculture, heat tolerant and shade plants in a landscape design, etc.).
		8.4.1.4	Create a design utilizing plants in their proper environments.
		8.4.1.5	Install plants according to a design plan that uses the proper plants based on the situation and environment.
		8.4.1.6	Evaluate a design and provide feedback and suggestions for improvement (e.g., a floral arrangement, a landscape or a landscape plan, etc.).
	8.4.2	**CREATE DESIGNS USING PLANTS.**	
		8.4.2.1	Research and summarize the principles and elements of design for use in plant systems.
		8.4.2.2	Identify and categorize tools used for design (e.g., computer landscape software, drawing tools, florist tools, etc.).
		8.4.2.3	Explain the concept of landscape ecology and summarize factors that shape the ecology of a landscape (e.g., composition, structure, function, etc.).
		8.4.2.4	Apply principles and elements of design that form the basis of artistic impression.
		8.4.2.5	Demonstrate the use of tools used for creating designs.
		8.4.2.6	Research and provide examples of ecological factors incorporated into landscape designs.
		8.4.2.7	Analyze designs to identify use of design principles and elements.
		8.4.2.8	Choose and properly use appropriate tools to create a desired design.
		8.4.2.9	Utilize green technologies and sustainable practices that prevent or limit negative environmental impacts.

Standard 9	POWER, STRUCTURAL, AND TECHNICAL SYSTEMS		
Topic 9.1	***Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural, and technical systems.***		
	Student Competencies		
	9.1.1	**APPLY PHYSICAL SCIENCE AND ENGINEERING PRINCIPLES TO ASSESS AND SELECT ENERGY SOURCES FOR AFNR POWER, STRUCTURAL, AND TECHNICAL SYSTEMS.**	
		9.1.1.1	Research and identify renewable and nonrenewable energy sources used in AFNR.
		9.1.1.2	Compare and contrast the pathways of delivery for renewable and nonrenewable energy sources in an AFNR enterprise or business.
		9.1.1.3	Summarize methods and compare and contrast units used to benchmark energy use of AFNR structures (e.g., EUIs, BTUs, etc.).
		9.1.1.4	Assess the environmental impacts of renewable and nonrenewable energy sources used in AFNR.
		9.1.1.5	Calculate the costs of using renewable and nonrenewable energy sources in an AFNR enterprise or business.
		9.1.1.6	Convert energy utilized in an AFNR structure to an energy utilization index (e.g., convert CCF, KWH, etc. to Btu consumption per square foot, etc.).
		9.1.1.7	Design and implement methods to evaluate the efficiency of renewable and nonrenewable energy sources used in AFNR.
		9.1.1.8	Devise a strategy to incorporate the use of selected energy sources in an ANFR enterprise or business.
		9.1.1.9	Apply energy benchmarking data to examine and select methods to conserve energy in AFNR structures.
	9.1.2	**APPLY PHYSICAL SCIENCE AND ENGINEERING PRINCIPLES TO DESIGN, IMPLEMENT, AND IMPROVE SAFE AND EFFICIENT MECHANICAL SYSTEMS IN AFNR SITUATIONS.**	
		9.1.2.1	Compare and contrast applications of simple machines in AFNR related mechanical systems.
		9.1.2.2	Identify the tools, machines, and equipment needed to construct and/or fabricate a project in AFNR.
		9.1.2.3	Examine owner's manuals to classify the types of safety hazards associated with different mechanical systems used in AFNR (e.g., caution, warning, danger, etc.).
		9.1.2.4	Perform mathematical calculations to determine the mechanical advantage of simple machines in AFNR related mechanical systems.
		9.1.2.5	Calculate the maintenance and purchase cost of tools, machines, and equipment used in AFNR.
		9.1.2.6	Select, maintain, and demonstrate the proper use of tools, machines, and equipment used in different AFNR related mechanical systems.
		9.1.2.7	Apply the scientific method to devise strategies to improve the efficiency of operation of AFNR related mechanical systems.

		9.1.2.8	Devise and document processes to safely implement and evaluate the safe use of AFNR related tools, machinery, and equipment.
		9.1.2.9	Conduct a safety inspection of tools, machines, and equipment used in different AFNR related mechanical systems.
	9.1.3	**APPLY PHYSICAL SCIENCE PRINCIPLES TO METAL FABRICATION USING A VARIETY OF WELDING AND CUTTING PROCESSES (E.G., SMAW, GMAW, GTAW, FUEL-OXYGEN AND PLASMA ARC TORCH, ETC.).**	
		9.1.3.1	Compare and contrast the principles and procedures of different welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).
		9.1.3.2	Compare and contrast the properties of different metals used in AFNR power, structural, and technical systems (e.g., malleability, conductivity, optical properties, chemical composition, etc.).
		9.1.3.3	Analyze the situation and determine the best welding and cutting process to be used in metal fabrication.
		9.1.3.4	Assess and select the proper electrode for use in various shielded metal arc welding situations.
		9.1.3.5	Evaluate the quality of metal fabrication procedures (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.).
		9.1.3.6	Construct and/or repair metal structures and equipment using metal fabrication procedures.
Topic 9.2	***Operate and maintain AFNR mechanical equipment and power systems.***		
	Student Competencies		
	9.2.1	**PERFORM PREVENTATIVE MAINTENANCE AND SCHEDULED SERVICE TO MAINTAIN EQUIPMENT, MACHINERY, AND POWER UNITS USED IN AFNR SETTINGS.**	
		9.2.1.1	Maintain the cleanliness and appearance of equipment, machinery, and power units used in AFNR power, structural, and technical systems to assure proper functionality.
		9.2.1.2	Examine operator's manuals to determine recommendations for servicing filtration systems and maintaining fluid levels on equipment, machinery, and power units used in AFNR power, structural, and technical systems.
		9.2.1.3	Develop a preventative maintenance schedule for equipment, machinery, and power units used in AFNR power, structural, and technical systems.
		9.2.1.4	Service filtration systems and maintain fluid levels on equipment, machinery, and power units in accordance with operator's manuals.
		9.2.1.5	Devise a strategy to communicate to different audiences, preventative maintenance, and service schedule for equipment, machinery, and power units used in AFNR power, structural, and technical systems.
		9.2.1.6	Assess and adjust equipment (e.g., belts and drives, chains, sprockets, etc.) and maintain fluid conveyance components (e.g., hoses, lines, nozzles, etc.) to ensure proper functioning.

	9.2.2	**OPERATE MACHINERY AND EQUIPMENT WHILE OBSERVING ALL SAFETY PRECAUTIONS IN AFNR SETTINGS.**	
		9.2.2.1	Research and summarize the use of equipment, machinery, and power units for AFNR power, structural, and technical systems.
		9.2.2.2	Examine and identify safety hazards associated with equipment, machinery, and power units used in AFNR power, structural, and technical systems (e.g., caution, warning, danger, etc.).
		9.2.2.3	Analyze and calculate the cost of using equipment, machinery, and power units for AFNR power, structural, and technical systems.
		9.2.2.4	Apply safety principles and applicable regulations to operate equipment, machinery, and power units used in AFNR power, structural, and technical systems.
		9.2.2.5	Perform pre-operation inspections, start-up, & shut-down procedures on equipment, machinery, and power units as specified in owner's manuals.
		9.2.2.6	Adjust equipment, machinery, and power units for safe and efficient operation in AFNR power, structural, and technical systems.
Topic 9.3	***Service and repair AFNR mechanical equipment and power systems.***		
	Student Competencies		
	9.3.1	**TROUBLESHOOT, SERVICE, AND REPAIR COMPONENTS OF INTERNAL COMBUSTION ENGINES USING MANUFACTURERS' GUIDELINES.**	
		9.3.1.1	Identify and classify components of internal combustion engines used in AFNR power, structural, and technical systems.
		9.3.1.2	Distinguish the characteristics of spark-and-compression internal combustion engines used in AFNR power, structural, and technical systems.
		9.3.1.3	Analyze and explain how the components of internal combustion engines interrelate during operation.
		9.3.1.4	Utilize technical manuals and diagnostic tools to determine service and repair needs of spark-and-compression internal combustion engines used in AFNR power, structural, and technical systems.
		9.3.1.5	Evaluate service and repair needs for internal combustion engines using a variety of performance tests (e.g., manuals, computer-based diagnostics, etc.).
		9.3.1.6	Inspect, analyze and repair spark-and-compression internal combustion engines used in AFNR power, structural, and technical systems.
	9.3.2	**SERVICE ELECTRICAL SYSTEMS AND COMPONENTS OF MECHANICAL EQUIPMENT AND POWER SYSTEMS USING A VARIETY OF TROUBLESHOOTING AND/OR DIAGNOSTIC METHODS.**	
		9.3.2.1	Compare and contrast basic units of electricity (e.g., volts, amps, watts, and ohms) and the principles that describe their relationship (e.g., Ohm's Law, Power Law, etc.).
		9.3.2.2	Compare and contrast the characteristics of electronic components used in AFNR power, structural, and technical systems (e.g., battery, resistor, diode, transistor, capacitor, etc.).
		9.3.2.3	Classify the uses of electrical sensors and controls in AFNR power, structural, and technical systems.

		9.3.2.4	Assess the tools used to measure the basic units of electrical circuits in AFNR power, structural, and technical systems, and perform the measurements.
		9.3.2.5	Analyze and interpret electrical system symbols and diagrams.
		9.3.2.6	Distinguish and select materials and tools used in electrical control circuit installation.
		9.3.2.7	Analyze and design electrical circuits for AFNR power, structural, and technical systems using knowledge of the basic units of electricity.
		9.3.2.8	Conduct testing procedures to evaluate and repair malfunctioning electrical components and systems used in AFNR power, structural, and technical systems.
		9.3.2.9	Plan and install electrical control circuits and/or circuit boards to assure proper operation within AFNR power, structural, and technical systems.
	9.3.3	**UTILIZE MANUFACTURERS' GUIDELINES TO DIAGNOSE AND TROUBLESHOOT MALFUNCTIONS IN MACHINERY, EQUIPMENT, AND POWER SOURCE SYSTEMS (E.G., HYDRAULIC, PNEUMATIC, TRANSMISSION, STEERING, SUSPENSION, ETC.).**	
		9.3.3.1	Research and summarize the applications of common types of hydraulic and pneumatic systems used in AFNR power, structural, and technical systems.
		9.3.3.2	Compare and contrast operation principles and features of mechanical transmission systems used in AFNR power, structural, and technical systems (e.g., belts, chains, gears, bearings, seals, universals, drive shafts, etc.).
		9.3.3.3	Identify and examine the components of suspension and steering systems used in AFNR power, structural, and technical systems.
		9.3.3.4	Analyze and interpret hydraulic and pneumatic system symbols and diagrams used in AFNR power, structural and technical systems.
		9.3.3.5	Utilize speed, torque, and power measurements to calculate efficiency in power transmission systems used in AFNR power, structural, and technical systems.
		9.3.3.6	Assess and analyze vehicle and machinery performance related to suspension and steering systems used in AFNR power, structural, and technical systems.
		9.3.3.7	Inspect, analyze, and repair hydraulic and pneumatic system components used in AFNR power, structural, and technical systems.
		9.3.3.8	Inspect, analyze, and repair the components of power transmission systems used in AFNR power, structural, and technical systems.
		9.3.3.9	Inspect, analyze, and repair vehicle suspension and steering systems used in AFNR power, structural, and technical systems.
Topic 9.4	***Plan, build, and maintain AFNR structures.***		
	Student Competencies		
	9.4.1	**CREATE SKETCHES AND PLANS FOR AFNR STRUCTURES.**	
		9.4.1.1	Interpret and explain the meaning of symbols used in sketches of agricultural structures.
		9.4.1.2	Read and interpret the parts and/or views of plans for agricultural structures.

	9.4.1.3	Apply scale measurement and dimension to develop sketches of agricultural structures.
	9.4.1.4	Construct plans for agricultural structures using current technology (e.g., drafting software, computer-aided design, etc.).
	9.4.1.5	Create sketches of an agricultural structure by applying principles of design.
	9.4.1.6	Evaluate, plan, and design functional and efficient facilities for use in AFNR power, structural, and technical systems.
9.4.2	**DETERMINE STRUCTURAL REQUIREMENTS, SPECIFICATIONS, AND ESTIMATE COSTS FOR AFNR STRUCTURES**	
	9.4.2.1	Summarize and categorize the information needed to complete a bill of materials and cost estimate for an AFNR structure.
	9.4.2.2	Research and summarize sources of industry construction and materials standards and their importance (e.g., American National Standards Institute, ANSI, Underwriters' Laboratories, UL, etc.).
	9.4.2.3	Analyze a project plan to prepare a bill of materials and an estimate of material costs.
	9.4.2.4	Assess and analyze local building code requirements for agriculture structures.
	9.4.2.5	Create a project cost estimate, including materials, labor, and management for an AFNR structure.
	9.4.2.6	Design and conduct a building functionality and safety assessment on an agricultural structure using knowledge of industry standards and local code requirements.
9.4.3	**FOLLOW ARCHITECTURAL AND MECHANICAL PLANS TO CONSTRUCT, MAINTAIN, AND/OR REPAIR AFNR STRUCTURES (E.G., MATERIAL SELECTION, SITE PREPARATION AND/OR LAYOUT, PLUMBING, CONCRETE/ MASONRY, ETC.).**	
	9.4.3.1	Examine the criteria in selecting materials for constructing, maintaining, and/or repairing AFNR structures.
	9.4.3.2	Summarize the characteristics needed for an ideal building site.
	9.4.3.3	Compare and contrast the characteristics of wood and/or metal products used in AFNR structures.
	9.4.3.4	Compare and contrast the characteristics of materials used in plumbing and water systems (e.g., copper, PVC, PEX, etc.).
	9.4.3.5	Compare and contrast the characteristics of fencing materials, including government regulations and applicable installation codes.
	9.4.3.6	Summarize the characteristics of the components found in concrete.
	9.4.3.7	Differentiate between types of insulation materials used in AFNR structures.
	9.4.3.8	Analyze and assess samples of materials or products for quality and efficiency of workmanship.
	9.4.3.9	Complete a building site analysis checklist to select an ideal building site.
	9.4.3.10	Calculate costs associated with the repair and replacement of wood and/or metal components an AFNR structure.
	9.4.3.11	Calculate the cost of a water system in an AFNR structure (e.g., copper, PVC, etc.).
	9.4.3.12	Measure and calculate the cost of fencing materials.
	9.4.3.13	Calculate volume for concrete projects.

		9.4.3.14	Calculate BTU loss in an AFNR structure.
		9.4.3.15	Select materials for a project based upon an analysis of the project and the quality of the materials.
		9.4.3.16	Assess site characteristics, identify adjustments, and demonstrate procedures for preparing a building site.
		9.4.3.17	Construct AFNR structures using wood and/or metal materials.
		9.4.3.18	Install and/or repair pipes and plumbing equipment and fixtures in AFNR structures.
		9.4.3.19	Construct, maintain, and/or repair fencing, including wood, static wire, electrical wire, and other fencing materials.
		9.4.3.20	Construct, maintain, and/or repair AFNR structures with concrete, brick, stone, or masonry.
		9.4.3.21	Insulate a structure and estimate reduced BTU loss.
	9.4.4	**APPLY ELECTRICAL WIRING PRINCIPLES IN AFNR STRUCTURES.**	
		9.4.4.1	Compare and contrast direct and alternating current.
		9.4.4.2	Distinguish electrical circuits and the components of each.
		9.4.4.3	Assess and analyze the electrical requirements of an AFNR structure.
		9.4.4.4	Calculate the cost of operating an electrical motor.
		9.4.4.5	Install and/or repair fixtures following appropriate codes and standards.
		9.4.4.6	Plan and wire electrical circuits (i.e., single pole switch, three-way switch, duplex outlet, etc.).
Topic 9.5	***Use control, monitoring, geospatial, and other technologies in AFNR power, structural, and technical systems.***		
	Student Competencies		
	9.5.1	**APPLY COMPUTER AND OTHER TECHNOLOGIES (E.G., ROBOTICS, CNC, UAS, ETC.) TO SOLVE PROBLEMS AND INCREASE THE EFFICIENCY OF AFNR SYSTEMS.**	
		9.5.1.1	Research and categorize computer technologies used to solve problems and increase efficiency in AFNR systems.
		9.5.1.2	Examine and summarize the specific intent of technologies used to solve problems and increase the efficiency of AFNR systems (e.g., robotics, UAS, CNC, etc.).
		9.5.1.3	Analyze data using computer programs and other current technologies used in AFNR systems.
		9.5.1.4	Calculate the change in efficiency after using technologies in AFNR systems.
		9.5.1.5	Solve problems and calculate changes in efficiency using computer technologies for AFNR systems.
		9.5.1.6	Solve problems and evaluate changes in efficiency and create recommendations for the use of technologies in AFNR systems.
	9.5.2	**PREPARE AND/OR USE ELECTRICAL DRAWINGS TO DESIGN, INSTALL, AND TROUBLESHOOT ELECTRONIC CONTROL SYSTEMS IN AFNR SETTINGS.**	
		9.5.2.1	Examine and categorize electrical control system components used in AFNR systems (e.g., transistors, relays, HVAC, logic controllers, etc.).
		9.5.2.2	Differentiate between the purpose of electrical sensors and controls used in AFNR power, structural, and technical systems.

	9.5.2.3	Research and summarize the importance of AFNR power, structural, and technical control systems using programmable logic controllers (PLC) and/or other computer-based systems.
	9.5.2.4	Analyze schematic drawings for electrical control systems used in AFNR systems.
	9.5.2.5	Interpret maintenance schedules for electrical control systems used in AFNR power, structural, and technical systems.
	9.5.2.6	Assess the functions of AFNR power, structural, and technical control systems using programmable logic controllers (PLC) in agricultural production and manufacturing.
	9.5.2.7	Design schematic drawings for electrical control systems used in AFNR systems.
	9.5.2.8	Troubleshoot electrical control system performance problems found in AFNR power, structural, and technical systems.
	9.5.2.9	Develop and implement AFNR power, structural, and technical control systems using programmable logic controllers (PLC) and/or other computer-based systems.
9.5.3	**APPLY GEOSPATIAL TECHNOLOGIES TO SOLVE PROBLEMS AND INCREASE THE EFFICIENCY OF AFNR SYSTEMS.**	
	9.5.3.1	Research and summarize the impact of utilizing geospatial technologies (i.e., GPS, GIS, remote sensing, telematics, etc.) in AFNR systems.
	9.5.3.2	Examine the components of precision technologies used in AFNR systems.
	9.5.3.3	Analyze and interpret trends in data collected utilizing geospatial technologies.
	9.5.3.4	Analyze and calculate the economic impact of utilizing precision technologies (e.g., GPS/GIS) in AFNR systems.
	9.5.3.5	Collect data and create maps utilizing geospatial technologies.
	9.5.3.6	Install, maintain, and service instrumentation and equipment used for precision technologies (i.e., GPS receivers, yield monitors, remote sensors, etc.) used in AFNR systems.

Career Ready Practices

1. Act as a Responsible and Contributing Citizen and Employee

Career-ready individuals understand the obligations and responsibilities of being a member of a community and demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them, think about the near-term and long-term consequences of their actions, and seek to act in ways that contribute to the betterment of their teams, families, community, and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

2. Apply Appropriate Academic and Technical Skills

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications and make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

3. Attend to Personal Health and Financial Well-Being

Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice health diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

4. Communicate Clearly, Effectively, and with Reason

Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice and organization and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

5. Consider the environmental, social, and economic impacts of decisions

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organizations and the environment. They are aware of and utilize new technologies, understandings, procedures, materials and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and profitability of the organization.

6. Demonstrate creativity and innovation

Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

7. Employ valid and reliable research strategies

Career-ready individuals are discerning in accepting and using new information to make decisions, change practices, or inform strategies. They use a reliable research process to search for new information and evaluate the validity of sources when considering the use and adoption of external information or practices. They use an informed process to test new ideas, information, and practices in their workplace situation.

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

Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur, quickly take action to address the problem, thoughtfully investigate the root cause of the problem prior to introducing solutions, and carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

9. Model integrity, ethical leadership, and effective management

Career-ready individuals consistently act in ways that align to personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the direction and actions of a team or organization, and they apply insights into human behavior to change others' actions, attitudes, and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morale, and organizational culture.

10. Plan education and career path aligned to personal goals

Career-ready individuals take personal ownership of their own educational and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience, and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the educational and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

11. Use technology to enhance productivity

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring and using new technology, being proficient with ubiquitous technology applications. They understand the inherent risks, personal and organizational, of technology applications, and they take actions to prevent or mitigate these risks.

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

Career-ready individuals positively contribute to every team whether formal or informal. They apply an awareness of cultural differences to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.