## Agricultural and Environmental Systems Career Field

## Agriculture, Food and Natural Resources

**Subject Code: 010105**

**Outcome & Competency Descriptions**

**Course Description:**

This first course in the career field is an introduction to Agricultural and Environmental Systems. Students will be introduced to the scope of the Agricultural and Environmental Systems career field. They will examine principles of food science, natural resource management, animal science & management, plant & horticultural science, power technology and bioscience. Students will examine the FFA organization and Supervised Agricultural Experience programs. Throughout the course, students will develop communication, leadership and business skills essential to the agriculture industry.

**Strand 1.**  **Business Operations/21st Century Skills**

Learners apply principles of economics, business management, marketing and employability in an entrepreneur, manager and employee role to the leadership, planning, developing and analyzing of business enterprises related to the career field.

**Outcome: 1.1. Employability Skills**

Develop career awareness and employability skills (e.g., face-to-face, online) needed for gaining and maintaining employment in diverse business settings.

**Competencies**

* + 1. Identify the knowledge, skills and abilities necessary to succeed in careers.
    2. Identify the scope of career opportunities and the requirements for education, training, certification, licensure and experience.

1.1.3. Develop a career plan that reflects career interests, pathways and secondary and postsecondary options.

1.1.4. Describe the role and function of professional organizations, industry associations and organized labor and use networking techniques to develop and maintain professional relationships.

**Outcome: 1.2. Leadership and Communications**

Process, maintain, evaluate and disseminate information in a business. Develop leadership and team building to promote collaboration.

**Competencies**

1.2.1. Extract relevant, valid information from materials and cite sources of information.

1.2.2. Deliver formal and informal presentations.

1.2.3. Identify and use verbal, nonverbal and active listening skills to communicate effectively.

1.2.5. Communicate information (e.g., directions, ideas, vision, workplace expectations) for an intended audience and purpose.

1.2.6. Use proper grammar and expression in all aspects of communication.

1.2.7. Use problem-solving and consensus-building techniques to draw conclusions and determine next steps.

1.2.14. Use motivational strategies to accomplish goals.

**Outcome: 1.4. Knowledge Management and Information Technology**

Demonstrate current and emerging strategies and technologies used to collect, analyze, record and share information in business operations.

**Competencies**

1.4.1. Use office equipment to communicate (e.g., phone, radio equipment, fax machine, scanner, public address systems).

1.4.2. Select and use software applications to locate, record, analyze and present information (e.g., word processing, e-mail, spreadsheet, databases, presentation, Internet search engines).

1.4.5. Use information technology tools to maintain, secure and monitor business records.

**Outcome: 1.6. Business Literacy**

Develop foundational skills and knowledge in entrepreneurship, financial literacy and business operations.

**Competencies**

1.6.1. Identify business opportunities.

1.6.2. Assess the reality of becoming an entrepreneur, including advantages and disadvantages (e.g., risk versus reward, reasons for success and failure).

1.6.3. Explain the importance of planning your business.

1.6.4. Identify types of businesses, ownership and entities (i.e., individual proprietorships, partnerships, corporations, cooperatives, public, private, profit, not-for-profit).

1.6.11. Describe how all business activities of an organization work within the parameters of a budget.

**Outcome: 1.7. Entrepreneurship/Entrepreneurs**

Analyze the environment in which a business operates, and the economic factors and opportunities associated with self-employment.

**Competencies**

1.7.7. Create a list of personal strengths, weaknesses, skills and abilities needed to be successful as an entrepreneur.

**Outcome: 1.8. Operations Management**

Plan, organize and monitor an organization or department to maximize contribution to organizational goals and objectives.

**Competencies**

1.8.9. Develop a budget that reflects the strategies and goals of the organization.

**Outcome: 1.9. Financial Management**

Use financial tools, strategies and systems to develop, monitor and control the use of financial resources to ensure personal and business financial well-being.

**Competencies**

1.9.1. Create, analyze and interpret financial documents (e.g., budgets, income statements).

1.9.2. Identify tax obligations.

1.9.3. Review and summarize savings, investment strategies and purchasing options (e.g., cash, lease, finance, stocks, bonds).

1.9.8. Identify income sources and expenditures.

**Outcome: 1.12. Site and Personal Safety Procedures**

Follow site and personal safety procedures in specific situations with specialized tools and equipment, evaluate the situation and take corrective action.

**Competencies**

1.12.1. Use Occupational Safety and Health Administration (OSHA) defined procedures for identifying

employer and employee responsibilities, working in confined spaces, managing worker safety

programs, using ground fault circuit interrupters (GFCIs), maintaining clearance and boundaries and labeling.

1.12.2. Interpret safety signs and symbols.

1.12.5. Identify the location of emergency flush showers, eyewash fountains, Safety Data Sheets (SDSs), fire alarms and exits.

1.12.7. Select, use, store, maintain and dispose of personal protective equipment (PPE), appropriate to job tasks, conditions and materials.

1.12.8. Identify safety hazards and take corrective measures.

1.12.9. Identify, inspect and use safety equipment appropriate for the task.

1.12.10. Follow established procedures for the administration of first aid and contact emergency medical personnel when necessary.

**Strand 2.**  **Animal Science**

Learners apply principles of animal anatomy, physiology, genetics, behavior, nutrition and production to the research and development, selection and reproduction, health and management of animals in domestic and natural environments.

**Outcome: 2.3. Care and Management**

Apply animal care, management and record procedures to ensure husbandry and welfare, including managing environmental conditions to ensure health and performance.

**Competencies**

2.3.1. Identify species-specific terminology (gender, age, reproductive status).

2.3.2. Identify, classify, evaluate and select animal species or breeds for a desired outcome.

**Strand 3.**  **Biotechnology**

Learners engage in the scientific process, learn fundamental processes using modern tools and laboratory techniques, adhere to safety protocols, and bring a biotechnology product to the market.

**Outcome 3.1. Research and Experiments**

Use scientific methodology to conduct problem-based studies, develop products, and interpret results.

**Competencies**

3.1.1. Design a research plan, including the significance of the problem, purpose, hypotheses, objectives, appropriate controls, independent variables, dependent variables, methods of study and a list of materials.

3.1.2. Examine sources for credibility.

3.1.6. Create, interpret and use tabular and graphical displays and describe the data.

3.1.10. Describe the relationships among variables using correlations and draw conclusions.

3.1.14. Describe how biotechnology products are produced and used in the United States.

3.1.15. Describe how biotechnology products are regulated in the United States.

**Outcome: 3.3. Specimen, equipment and chemical handling**

Handle, prepare, transport, store and dispose of specimens and chemicals. Monitor, record and maintain the integrity of equipment and instrumentation, environmental conditions of the facility and inventory.

**Competencies**

3.3.7. Select personal protective attire for various laboratory protocols.

3.3.8. Identify required tools and procedures of different biosafety levels.

**Outcome: 3.6. Molecular-Genetics Technology**

Apply knowledge of genetic inheritance and modification to organisms and use genetic information and bioinformatics to analyze specimens.

**Competencies**

3.6.1. Use a Punnet square to predict and explain Mendel’s Laws, genotype and phenotype.

**Strand 4.**  **Power Systems**

Learners apply principles of tool use, power transmission, hydraulics, pneumatics, two- and four-stroke cycle combustion, exhaust, ignition, fuel, starting and charging, steering, HVAC, and lubrication systems to operate, maintain and repair equipment.

**Outcome: 4.1. Tool, Stationary and Mobile Equipment Maintenance**

Inspect, clean, maintain and perform preventative maintenance on equipment.

**Competencies**

4.1.2. Identify types of hand tools, power tools and equipment and describe their functions.

**Outcome: 4.3. Engines**

Apply concepts to service components of both small and large internal combustion engines per the OEM (original equipment manufacturer) operator’s manual.

**Competencies**

4.3.1. Assess the physical and mechanical principles of engine operation, including motion, friction and thermodynamics.

4.3.5. Compare and contrast two-cycle and four-cycle engines and their operating principles.

**Strand 5.**  **Elements of Production**

Learners apply principles of practice related to the management and maintenance of food, agriculture and natural resources systems.

**Outcome: 5.3. Design and Estimate**

Interpret basic site plan for a desired outcome or company specification.

**Competencies**

5.3.1. Identify, interpret and use symbols, drawings, prints, and blueprints.

5.3.2. Apply proportional measurement and scale techniques.

**Outcome 5.5. Geographic Information Systems (GIS)**

Employ GIS computer applications to interpret data, maps and land use.

**Competencies**

5.5.8. Determine one’s position on the earth using GPS.

5.5.12. Identify suitability of given area for agricultural applications.

**Outcome: 5.6. Construction**

Follow architectural plans to construct and repair agricultural structures and hardscapes.

**Competencies**

5.6.2. Lay out, cut, smooth, shape and bore construction materials.

**Outcome: 5.9. Physics and Metallurgy of Welding**

Apply the physics and metallurgy of welding in joining metals.

**Competencies**

5.9.1. Assess how the welding arc produces a weld.

**Outcome: 5.10. Joining and Cutting Ferrous and Non-Ferrous Materials with Heat**

Join and cut ferrous and non-ferrous materials using heat in horizontal and vertical positions.

**Competencies**

5.10.3. Compare and contrast ferrous and non-ferrous material welding operating characteristics and performance.

**Outcome 5.12. Precision Agriculture**

Analyze data from precision agriculture platforms and prepare recommendations.

**Competencies:**

5.12.1. Identify a list of agricultural enterprises that can benefit from precision agriculture.

5.12.8. Apply precision agriculture information to specifically reduce the negative environmental impacts of production practices.

**Outcome 5.15. Animal Behavior**

Apply management practices to assure animal welfare considering species-specific behaviors, human safety, social influences, public perception and regulations associated with animal welfare.

**Competencies:**

5.15.1. Understand social influences, public perception and regulations that are associated with animal welfare.

5.15.9. Identify and describe the impacts of animal welfare and handling on meat quality and food safety.

**Strand 6.**  **Environmental Science**

Learners apply earth, life, and physical sciences to the production, extraction, processing, protection, use, and renewal of both renewable and non-renewable resources.

**Outcome: 6.1. Soils**

Apply knowledge of soil characteristics and soil information resources to overcome any existing soil use limitations while maintaining or improving soil quality.

**Competencies**

6.1.1. Identify soil forming factors and explain how they produce variability in soils.

6.1.3. Collect, test and analyze soil samples for physical and chemical properties.

**Outcome: 6.2. Water Quality**

Analyze, interpret, and manage the biological, chemical and physical properties of water quality.

**Competencies**

6.2.1. Assess and explain the interactions between human activities and the Earth’s hydrosphere (e.g., septic systems, desalinization, point and non-point source pollution).

**Outcome: 6.11. Habitat Management and Restoration**

Develop a plan for the management and restoration of a specific habitat.

**Competencies**

6.11.3. Evaluate the current and historical (e.g., industrialism, agriculture, climate change) impacts of human interactions on ecosystems and habitats.

6.11.4. Identify and differentiate extinct, endangered, extirpated, threatened, and species of concern.

**Strand 7.**  **Food Science**

Learners apply principles of biology, chemistry and physics to the research, development, production, processing and distribution of food products meeting food safety and quality assurance standards in a secure system.

**Outcome: 7.2. Quality Assurance**

Inspect the food production process, locate potential sources of food quality and safety deviations in facilities and prepare a corrective action plan.

**Competencies**

7.2.2. Describe the quality attributes (e.g., color, flavor, textures) that a food product possesses.

**Outcome: 7.5. Food Product Development**

Apply principles of nutrition and human behavior to create a new food prototype.

**Competencies**

7.5.1. Conduct a sensory evaluation of food products.

7.5.4. Identify nutrient values, serving sizes, and nutrient variability for a food product.

**Strand 8.**  **Plant Science**

Learners apply principles of plant anatomy, physiology, nutrition and genetics to the research and development, selection and reproduction, planting, fertilization, health, harvesting and management of plants in a domestic and/or natural environment.

**Outcome: 8.1. Plant Nutrition**

Select and apply macronutrients and micronutrients based on deficiencies identified from the use of industry-driven testing, application, methods and optimum management strategies that account for environmental factors.

**Competencies**

8.1.3. Identify and describe the nutrient recommendations of a plant for a desired production.

**Outcome: 8.4. Growth and Management**

Explain, manage and manipulate plants through all stages of growth and development.

**Competencies**

8.4.1. Identify and classify plants using taxonomy.

8.4.2. Identify plant anatomical structures and their functions.

8.4.5. Explain the requirements of photosynthesis and identify the products and byproducts.

**Strand 9.**  **Energy**

Learners apply principles of physics, chemistry, earth sciences and mathematics to energy sources, transformations, acquisition, applications, and their impacts.

**Outcome: 9.1. Energy**

Identify energy sources according to their economic viability, sustainability and environmental impact.

**Competencies**

9.1.1. Identify, compare and contrast fossil fuel sources (e.g., oil, natural gas, and coal) and the technology used to generate energy.

9.1.2. Identify, compare and contrast renewable energy sources and the technology used to generate energy.

9.1.3. Identify, compare and contrast alternative and emerging energy sources and technology used to generate energy (e.g., fuel cells, hydrogen, nuclear).

9.1.4. Identify the social, economic and environmental drivers and barriers that influence the development and use of energy sources.