# Agricultural and Environmental Systems Career Field

## Applications of Food Science and Safety

**Subject Code: 011030**

**Outcome & Competency Descriptions**

**Course Description:**

Learners demonstrate principles and practices of food safety, processing and packaging to develop solutions for problems in food production, handling and storage. Learners will examine a full range of food processing techniques. Learners will examine the process of food product development and techniques used to measure food sensory aspects, shelf life and food stability. Learners will examine government regulation’s impact on labeling, new packaging technologies, harvesting, transportation, and the environment. Food laws, regulations and regulatory and commercial grading standards will be examined.

**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: 1.3. Business Ethics and Law**

Analyze how professional, ethical and legal behavior contributes to continuous improvement in organizational performance and regulatory compliance.

**Competencies**

1.3.1. Analyze how regulatory compliance (e.g., United States Department of Agriculture [USDA], Food and Drug Administration [FDA], United States Department of Interior [USDI], Ohio Livestock Care Standards, water quality standards, local water regulations, building codes) affects business operations and organizational performance.

1.3.2. Follow protocols and practices necessary to maintain a clean, safe and healthy work environment.

1.3.4. Identify how federal and state consumer protection laws affect products and services.

1.3.5. Access and implement safety compliance measures (e.g., quality assurance information, safety data sheets [SDSs], product safety data sheets [PSDSs], United States Environmental Protection Agency [EPA], United States Occupational Safety and Health Administration [OSHA]) that contribute to the continuous improvement of the organization.

**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**

1.12.5. 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.

**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: 7.1. The Science of Food**

Differentiate the structures, functions and sources of ingredients and the roles they play in food product development for human nutrition.

**Competencies**

7.1.1. Classify components of foods into nutrient categories.

7.1.2. Identify sources and forms of energy in foods.

7.1.3. Measure and describe the role of pH in food processing and storage.

7.1.4. Measure and describe water activity and differentiate how water activity affects food functionality and storage.

7.1.5. Describe the composition and structure of sugars, complex carbohydrates, lipids, vitamins, minerals and proteins.

7.1.6. Identify sources of sugars, complex carbohydrates, lipids, vitamins, minerals and proteins, and their nutritional contributions to dietary needs.

7.1.7. Relate the functions and physical properties of simple and complex carbohydrates, lipids, vitamins, minerals and proteins (i.e., functional ingredients) to the manufacturing of food products.

7.1.8. Describe the roles of enzymes as catalysts and the factors that affect enzyme activity.

7.1.9. Differentiate the metabolic processes and the factors that affect metabolic changes in the human body, including anabolism, catabolism and basal metabolism.

7.1.10. Identify and describe the functions of food additives in food products.

7.1.11. Identify and describe regulations regarding food additives.

7.1.12. Identify the characteristics and properties of mixtures and select and apply appropriate chemical or biological separation techniques.

**Outcome: 7.2. Quality Assurance**

Inspect the food production process and locate potential sources of food quality and safety deviations in facilities.

**Competencies**

7.2.1. Describe the types of spoilage (e.g., oxidation, microbial), their sources and impact.

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

7.2.3. Identify molds, bacteria, viruses, prions and yeast and describe their roles in food production.

7.2.4. Identify molds, bacteria, viruses, prions and yeast and describe how they reproduce and factors that affect their growth.

7.2.5. Test food quality through chemical, microbiological, sensory and physical methods.

7.2.6. Evaluate, inspect and select raw food products for manufacturing, based on raw ingredient specifications.

7.2.7. Develop a quality check list, based on finished food product attributes, specifications and regulations.

7.2.9. Compare and contrast food safety, food fraud and food defense.

7.2.10. Describe the relationship between timeliness of processing or production to product quality.

7.2.11. Identify the importance of data collection and management and its relationship to a quality assurance program.

7.2.12. Record and manage data relevant to a quality assurance program.

**Outcome: 7.4. Food Production and Processing**

Process a safe shelf stable food product for distribution and consumption.

**Competencies**

7.4.1. Describe the processes used in food preservation, control the variables, and apply biological processing methods.

7.4.2. Describe the process of dehydration and concentration, control the variables that affect the quality of dried foods and apply the methods.

7.4.3. Describe the functions and types of packaging operations, equipment and materials and use them to manufacture food products (e.g., metal, glass, paper, plastic, film, laminates, edible coatings, biodegradable).

7.4.4. Process food through mixing, grinding, pumping and washing and describe the physical change in the food product.

7.4.5. Identify and apply food grading systems and standards of identity.

7.4.6. Compare and contrast storage and distribution methods for shelf-stable and non-shelf-stable products.

7.4.7. Differentiate among beneficial microorganisms (e.g., bacteria, mold, yeast) and their uses in food production.

7.4.8. Process food products through biological processing.

7.4.9. Describe the role of enzymes as catalysts and factors that affect enzyme activity in the fermentation process.

7.4.10. Determine the environmental impacts and manage the waste of processing a food product.

**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.

7.5.2. Identify consumer preferences, trends and opportunities affecting food product development.

7.5.3. Manipulate ingredients to meet a desired product goal.

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

7.5.5. Calculate the amounts of restricted ingredients in food products.

7.5.6. Develop a food product package and label according to industry standards.

7.5.7. Estimate the shelf life and potential changes in attributes over time.

7.5.8. Create a new product roll out plan (e.g., concept, bench trial, market assessment, industrial trial, consumer acceptance).

**Outcome: 7.6. Food Safety and Sanitation**

Develop a food safety and sanitation plan, addressing processing facility needs and contamination points.

**Competencies**

7.6.1. Identify and control food product allergens.

7.6.2. Establish and implement procedures for preoperational inspection and cleaning.

7.6.3. Identify the sources and most prevalent types of food-borne bacteria and pathogens to account for the potential of their entrance into the food supply.

7.6.4. Describe good manufacturing practices and the correlating corrective actions.

7.6.5. Identify and describe food-borne hazards.

7.6.6. Identify and describe points in production where food safety hazards can be controlled.

7.6.7. Identify and describe critical limits.

7.6.8. Identify and describe a corrective action plan.

7.6.9. Identify the key activities (e.g., recall exercise, regulatory notification) of a recall program.

7.6.10. Identify the government agencies involved in the regulation and governance of food production.

7.6.11. Compare and contrast food security and food defense.

7.6.12. Identify sources of physical, biological, radiological, and chemical tampering points.

7.6.13. Manage the biosecurity of raw materials and finished products during transportation.