**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 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.

*An “X” indicates that the pathway applies to the outcome.*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Pathways** |  | Agribusiness and Production Systems |  | Animal Science and Management | X | Bioscience | | |  | Horticulture |
|  | Natural Resource Management |  | Power Technology | | |  |  | | |
| **Green Practices** |  | Green-specific |  | Context-dependent | | |  | Does not apply | | |

**Strand 7. Food Science**

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

**Outcome: 7.1. The Science of Food**

Differentiate the structures, functions and sources of basic functional ingredients and the roles they play in the development and manufacturing of food products for human nutrition.

**Competencies**

7.1.1. Classify the matter in foods by elements, compounds, mixtures, chemical bonds, organic and

inorganic properties and physical and chemical changes.

7.1.2. Distinguish the sources and forms of energy, the relationship between heat and temperature, how heat is transferred and the factors that affect the rates of reaction in food processing.

7.1.3. Measure the acidity, alkalinity and molarity of food products and describe the role of pH in food processing and storage.

7.1.4. Assess water’s function in food processing, distinguish between moisture content and water activity and differentiate how water activity affects food functionality and storage.

7.1.5. Describe the composition, structure and sources of sugars, complex carbohydrates, lipids, vitamins, minerals and proteins (i.e., functional ingredients) and their nutritional contributions to dietary needs.

7.1.6. 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.

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

7.1.8. Differentiate the metabolic processes and the factors that affect metabolic changes in the human body (i.e., anabolism, catabolism, basal metabolism).

7.1.9. Describe the structure of molds, bacteria, viruses, prions and yeast; how they reproduce; the factors that affect their growth and their roles in food production.

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

**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**

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

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

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

7.2.6. Describe types of quality systems (e.g., Global Food Safety Initiative [GFSI], International

Organization for Standardization [ISO], Safe Quality Food [SQF], British Retail Consortium [BRC]).

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

Process a food product for distribution and consumption.

**Competencies**

7.4.1. Describe the process used in thermal and non-thermal preservation, control the variables and apply processing methods (e.g., retorting, high pressure, ultra-high temperature [UHT], high temperature short time [HTST], chilling, freezing).

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).

7.4.4. Compare and contrast reduced oxygen packaging (ROP) processes (e.g., controlled and modified atmosphere packaging, desiccants) and use them to manufacture food products.

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

7.4.6. Identify the characteristics and properties of mixtures (e.g., solutions, colloidal dispersions and

suspensions) and select and apply appropriate chemical or biological separation techniques.

7.4.7. Process raw materials and products and apply food grading systems and standards of identity.

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

7.4.9. Determine the environmental impact of processing a food product.

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

7.4.11. Process food products through biological processing (e.g., fermenting, enzymes, microbes).

7.4.12. Manage processes for handling the solid and liquid waste from manufacturing food products.

**Outcome: 7.5. Food Product Development**

Apply principles of nutrition and human behavior to create a new food prototype that meets a specific dietary need or demand for consumption, design packaging and seek label approval.

**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. Calculate 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 new uses for low value components of the food generation process.

**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, isolate, and monitor food product allergens.

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

7.6.3. Identify the sources and types of food-borne illness and pathogens and prevent their entrance into the food supply.

7.6.4. Develop and implement a pest control system.

7.6.5. Conduct a good manufacturing practice (GMP) audit, review the findings and implement corrective actions.

7.6.6. Identify and monitor hazards and critical control points and apply hazard analysis and critical control point (HAACP) corrective action procedures.

7.6.7. Determine critical safety parameters using government regulations for handling and storage.

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

7.6.9. Identify the government agencies involved in the production and regulation of food products.

**Outcome: 7.7. Biosecurity**

Connect the sources and causes of contamination and develop the protocols to implement bio-security procedures.

**Competencies**

7.7.1. Investigate sources and origins of agents that can contaminate processed and unprocessed food products.

7.7.5. Implement biosecurity procedures to prevent cross-site contamination (e.g., proper use and disposal of personal protective equipment [PPE] from site to site, vehicle cleaning between farm and processing site).

7.7.7. Select bio-containment practices (e.g., quarantine, eradicate, showering into facilities) to manage pests and diseases.

*An “X” indicates that the pathway applies to the outcome.*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Pathways** |  | Agribusiness and Production Systems |  | Animal Science and Management | X | Bioscience | | |  | Horticulture |
|  | Natural Resource Management |  | Power Technology | | |  |  | | |
| **Green Practices** |  | Green-specific |  | Context-dependent | | |  | Does not apply | | |