## Agricultural and Environmental Systems Career Field

## Meat Science and Technology

**Subject Code: 011020**

**Outcome & Competency Descriptions**

**Course Description:**

Students will apply food chemistry and microbiology to processing, preservation, packaging, storage and marketing of meat products. Students will design and implement a quality assurance program that meets legal compliance and demonstrates knowledge of safe operation and maintenance of equipment and facilities. Students will evaluate carcass composition, assign quality grades, and examine valued-added products. Throughout the course, students will demonstrate customer service and sales techniques while understanding the scope and importance of business and safety regulations.

**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 Business Operations/21st Century Skills**

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

**Competencies**

1.1.1.Identify the knowledge, skills and abilities necessary to succeed in careers.

1.1.2. Identify the scope of career opportunities and the requirements for education, training, certification, licensure and experience.

1.1.9. Give and receive constructive feedback to improve work habits.

**Outcome: 1.2. Leadership and Communications**

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

**Competencies**

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

1.2.4. Use negotiation and conflict-resolution skills to reach solutions.

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: 1.3. 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.

1.3.3. Use ethical character traits consistent with workplace standards (e.g., honesty, personal integrity, compassion, justice).

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.

1.3.6. Identify deceptive practices (e.g., bait and switch, identity theft, unlawful door-to-door sales, deceptive service estimates, fraudulent misrepresentations) and their overall impact on organizational performance.

1.3.7. Identify the labor laws that affect employment and the consequences of noncompliance for both employee and employer (e.g., harassment, labor, employment, employment interview, testing, minor labor laws, Americans with Disabilities Act, Fair Labor Standards Acts, Equal Employment Opportunity Commission [EEOC]).

1.3.9. Identify potential conflicts of interest (e.g., personal gain, project bidding) between personal, organizational and professional ethical standards.

**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**

1.4.2. Select and use software applications to locate, record, analyze and present

information (e.g., word processing, e-mail, spreadsheet, databases, presentation, Internet search engines)

1.4.7. Use personal information management and productivity applications to optimize

assigned tasks (e.g., lists, calendars, address books).

**Outcome: 1.5. Global Environment**

Evaluate how beliefs, values, attitudes and behaviors influence organizational strategies and goals.

**Competencies**

1.5.3. Use cultural intelligence to interact with individuals from diverse cultural settings.

1.5.6. Analyze work tasks for understanding and interpretation from a different cultural perspective.

**Outcome: 1.6. Business Literacy**

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

**Competencies**

1.6.6. Identify the target market served by the organization, the niche that the organization fills and an outlook of the industry.

1.6.7. Identify the effect of supply and demand on products and services.

1.6.8. Identify the features and benefits that make an organization’s product or service competitive.

**Outcome: 1.8. Operations Management**

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

**Competencies**

1.8.1. Forecast future resources and budgetary needs using financial documents (e.g., balance sheet, demand forecasting, financial ratios).

1.8.2. Select and organize resources to develop a product or a service.

1.8.5. Use inventory and control systems to purchase materials, supplies and equipment (e.g., Last In, First Out [LIFO]; First In, First Out [FIFO]; Just in Time [JIT]; LEAN).

1.8.8. Identify routine activities for maintaining business facilities and equipment.

**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).

1.9.8. Identify income sources and expenditures.

**Outcome: 1.10. Sales and Marketing**

Manage pricing, place, promotion, packaging, positioning and public relations to improve quality customer service.

**Competencies**

1.10.1. Identify how the roles of sales, advertising and public relations contribute to a company’s brand.

1.10.2. Determine the customer's needs and identify solutions.

1.10.3. Communicate features, benefits and warranties of a product or service to the customer.

1.10.5. Monitor customer expectations and determine product/service satisfaction by using measurement tools.

1.10.6. Discuss the importance of correct pricing to support a product’s or service’s positioning in the marketing mix.

1.10.7. Describe the importance and diversity of distribution channels (i.e., direct, indirect) to sell a product.

1.10.8. Use promotional techniques to maximize sales revenues (e.g., advertising, sales promotions, publicity, public relations).

1.10.10. Demonstrate sales techniques.

**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.

1.12.4. Describe how working under the influence of drugs and alcohol increases the risk of accident, lowers productivity, raises insurance costs and reduces profits.

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

1.12.6. Identify procedures for the handling, storage and disposal of hazardous materials.

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.

1.12.11. Set up for ergonomic workflow.

**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: 2.5. Animal Health**

Implement preventive measures, treatment and maintenance options for species-specific diseases and disorders to improve an animal’s health and welfare.

**Competencies**

2.5.6. Describe the routes of administration for medications (oral, IM, IV, SQ) and the process of drug absorption, distribution, metabolism, withdrawal and excretion.

**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**

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

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

4.1.4. Identify potential hazards and limitations related to the use of equipment.

4.1.5 Maintain organization, and cleanliness of facilities, machinery, equipment, and tools for safety and appearance.

4.1.8. Inspect, clean, lubricate, and adjust equipment for safe operation.

**Outcome: 4.2. Equipment Operations**

Operate and maintain mechanical equipment and power systems.

**Competencies**

4.2.1. Follow Original Equipment Manufacturer (OEM) recommended operating procedures and adjustment specifications as found in the operator’s manual.

4.2.2. Differentiate among the functions, limitations and proper use of equipment, equipment controls and instrumentation.

4.2.3. Perform pre- and post-operation inspections and adjustments and report malfunctions.

4.2.4. Perform appropriate start-up, operating and shut-down procedures.

4.2.5. Select and operate equipment and attachments needed to complete the task per the original Equipment Manufacturer (OEM) operator’s manual.

**Strand 5 Elements of Production**

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

**Outcome: 5.16. Biosecurity**

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

**Competencies**

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

5.16.2. Identify activities and biological agents that contribute to the risk of acquiring or preventing a specific disease.

5.16.3. Identify sources of biological and chemical tampering points.

5.16.4. Assess a facility's biosecurity, classify the level of risk and recommend improvements.

5.16.5. 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).

5.16.6. Screen and test animals and plant products for infectious agents or contamination.

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

5.16.8. Manage the biosecurity of raw materials and finished products during transportation (e.g., security seals, chain of custody).

**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: 6.7. Solid Waste and Renewable Resource Management**

Control and process solid waste using current and alternative technologies.

**Competencies**

6.7.1. Collect, analyze and treat solid waste materials (e.g., livestock mortalities, manure, garbage, food waste).

6.7.3. Determine an acceptable site for solid waste disposal.

6.7.5. Describe and monitor solid waste disposal procedures (e.g., landfill, compost).

6.7.6. Describe and monitor solid waste disposal procedures and management procedures (e.g., composting, incineration, recycling, burial, bio digester).

6.7.10. Determine type and volume of solid waste generated by an operation or facility.

**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 basic functional ingredients and the roles they play in food product development for human nutrition.

**Competencies**

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.

7.1.8. 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.

**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.

7.2.8. Identify elements commonly included on the principal display and information panels on a food product.

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

**Outcome: 7.3. Meat Science**

Identify the role of inspection, sanitation, food safety, and proper harvesting practices; the role of carcass evaluation and grading on meat quality and percent saleable products and cutting guidelines from primal to retail meat cuts.

**Competencies**

7.3.1. Identify the benefits and roles of antemortem inspection, in relation to food safety.

7.3.2. Identify the benefits and roles of postmortem inspection in relation to food safety.

7.3.3. Describe humane harvesting techniques and their impact on meat quality.

7.3.4. Remove and inspect offal postmortem for signs of disease or contamination.

7.3.5. Prepare a carcass through species-specific techniques for postmortem inspection.

7.3.6. Describe the role and impacts of the conversion of muscle to meat-on-meat quality.

7.3.7. Evaluate and describe the role of marbling on overall quality grade.

7.3.8. Evaluate retail cuts of meat to determine both quality and economic value.

7.3.9. Determine the maturity of an animal using skeletal ossification and lean maturity ratings and determine those impacts on the overall quality grade per USDA grading.

7.3.10. Calculate percentage saleable product from yield grades utilizing the USDA formula in estimating percent boneless closely trimmed retail cuts.

7.3.11. Calculate beef carcass value using a grid-based marketing system.

7.3.12. Fabricate carcasses into species-specific wholesale and retail cuts.

**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**

7.5.2. 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.

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

Describe 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 active 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.