Department of Education | College, Career and Technical Education

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Advanced Food Science

Primary Career Cluster:	Agriculture, Food, & Natural Resources
Course Contact:	CTE.Standards@tn.gov
Course Code(s):	C18H24
Prerequisite(s):	*Food Science and Safety* (C18H26)
Credit:	1
Grade Level:	12
Elective Focus - Graduation Requirements:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Agriculture, Food, & Natural Resources courses. In addition, this course satisfies the third lab science credit requirement for graduation.
POS Concentrator:	This course satisfies one out of two required courses to meet the Perkins V concentrator definition, when taken in sequence in the approved program of study.
Programs of Study and Sequence:	This is the fourth and final course in the *Food Science* program of study.
Aligned Student Organization(s):	FFA: http://www.tnffa.org
Coordinating Work-Based Learning:	All Agriculture students are encouraged to participate in a Supervised Agricultural Experience (SAE) program. In addition, teachers who hold an active WBL certificate may offer placement for credit when the requirements of the state board's WBL Framework and the Department's WBL Policy Guide are met. For information, visit https://www.tn.gov/content/tn/education/career-and-technical-education/work-based-learning.html.
Promoted Tennessee Student Industry Credentials:	Credentials are aligned with postsecondary and employment opportunities and with the competencies and skills that students acquire through their selected program of study. For a listing of promoted student industry credentials, visit https://www.tn.gov/education/career-and-technical-education/student-industry-certification.html
Teacher Endorsement(s):	048, 150, 448, and 950
Required Teacher Certifications/Training:	None
Teacher Resources:	https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-agriculture-food-natural-resources.html Best for All Central: https://bestforall.tnedu.gov/

Approved April 10, 2015; Amended April 15, 2016; Nov. 6, 2020; Nov. 2022

Course at a Glance

CTE courses provide students with an opportunity to develop specific academic, technical, and 21st century skills necessary to be successful in career and in life. In pursuit of ensuring every student in Tennessee achieves this level of success, we begin with rigorous course standards which feed into intentionally designed programs of study.

Students engage in industry relevant content through general education integration and experiences such as career & technical student organizations (CTSO) and work-based learning (WBL). Through these experiences, students are immersed with industry standard content and technology, solve industry-based problems, meaningfully interact with industry professionals and use/produce industry specific, informational texts.

Using a Career and Technical Student Organization (CTSO) in Your Classroom

CTSOs are a great resource to put classroom learning into real- life experiences for your students through classroom, regional, state, and national competitions, and leadership opportunities. Below are CTSO connections for this course, note this is not an exhaustive list.

- Participate in CTSO Fall Leadership Conference to engage with peers by demonstrating logical thought processes and developing industry specific skills that involve teamwork and project management.
- Participate in FFA career and leadership events (CDE/LDE) that align with this course including Agriscience Fair, Agricultural Issues, Meats Evaluation, and Technology and Milk Quality and Products.

Using a Work-based Learning (WBL) in Your Classroom

Sustained and coordinated activities that relate to the course content are the key to successful work-based learning. Possible activities for this course include the following. This is not an exhaustive list.

- **Standards 1.1-1.4** | During a visit to a food processing plant ask the manager to talk about safety in the workplace.
- **Standards 2.1-2.4, 4.1-4.3 |** Have the students work with a butcher or in a meat department to prepare red meat products for retail sale.
- **Standards 3.1-3.5** | Have the students work with a local dairy processing facility or work with a industry representative to develop a value added dairy product.
- **Standards 5.1-5.2** | Contact an agricultural inspector to talk with the class about equipment, crops, safety, sanitation, and quality control within the vegetable, fruit, and nut industry.
- **Standards 6.1-6.2** | Have the students do a project that is supervised or evaluated by a manager of a local company.
- **Standards 7.1-7.2**| Visit a local farmers market and have the students' interview venders on marketing strategies and develop and present an agricultural product marketing plan.
- **Standards 8.1-8.3** | Discuss consumer related issues within the food processing industry with food processing plant manager or marketing department representative.

Course Description

Advanced Food Science is an applied course designed to prepare students for further education and careers in food science and technology. This course covers advanced principles of food science, characteristics and properties of food products, processing, grading techniques and skills, and food

labeling and packaging principles. Upon completion of this course, proficient students will be able to pursue advanced training in food science at a postsecondary institution.

Course Standards

1. Introduction to Food Processing

1.1 Occupational Trends: Investigate **real-time and projected local, regional, state, and national occupational trends** in the food science industry. Compare and contrast the **knowledge, skills, and abilities necessary for employment**, as well as the typical **level of education required**.

1.2 Overview of Food Science Principles: Summarize how **principles of food preservation are applied to the conversion of agricultural commodities into consumer products**. Determine how **food safety techniques are applied in the home, at retail establishments, and in commercial food processing environments** to benefit human health.

1.3 Laboratory Safety: Review common **laboratory safety procedures** for tool and equipment operation in food processing facilities and analysis laboratories, including but not limited to accident prevention and control procedures. Demonstrate the ability to follow safety and operational procedures in a lab setting and complete a safety test with 100 percent accuracy.

1.4 Recordkeeping: Demonstrate the ability to prepare **basic personal and business records** to complete taxes, employment, and SAE related applications, including quality control records, resume, budgets, income statements, balance sheets, cash flow statements, profit and loss statements, and equity statements.

2. Processing and Evaluation of Red Meat

2.1 Meat protein: Identify the **major species and breeds of livestock** utilized for red meat production. Describe the **fabrication, processing, packaging, and quality assessment** of red meats and their by-products.

2.2 Carcass inspection and grading: Analyze the United States Department of Agriculture (USDA) inspection and grading procedures and justify their purpose. Describe the principles of quality and yield grading. Perform the evaluation and grading of carcasses, wholesale cuts, and retail cuts to determine maturity, final quality grade, and final yield grade, and provide written and oral justification for evaluation conclusions.

2.3 Carcass processing: Explain **carcass preparation and fabrication procedures** and identify associated equipment, safety, sanitation, and quality control procedures. Identify **wholesale and retail cuts of meat and meat by-products**, and correlate them to major muscle groups.

2.4 Further processing and value-added: Describe the different **methods of further processing fabrication for processed and value-added products** including comminuted meat products, emulsions, and cured meats by species. Calculate proper meat product formulations based upon required protein levels and USDA allowances for various meat products.

3. Processing and Evaluation of Milk and Dairy Products

3.1 Dairy breeds: Identify major **breeds of livestock utilized for dairy production**. Describe the products, by-products, processing procedures, packaging requirements, and quality analysis associated with each breed.

3.2 Milk storage and transfer from the farm to the processor: Summarize the **requirements for a dairy farm to produce Grade A or Grade B raw milk**. Describe the procedures used to transfer bulk milk from the farm to the processing facility, ensuring quality and safety are conserved.

3.3 Milk and dairy products quality testing: Summarize **quality tests and testing procedures commonly used to produce milk and dairy products**. Perform quality evaluations of milk and dairy products, providing written and oral justification for evaluation conclusions.

3.4 Milk processing procedures: Describe **milk collection and processing procedures**, addressing procedures specific to equipment, safety, sanitation, and quality control. Analyze the composition of milk and examine concepts and principles that verify the scientific foundation for the pasteurization process.

3.5 Cultures and fermentation: Identify **varieties and characteristics of cultured and frozen milk products**. Identify and explain the processes, procedures, and typical microorganisms used to produce buttermilk, yogurt, and sour cream.

3.6 Cheese Processing: Identify **varieties, characteristics, and classifications of cheeses**. Demonstrate in a live setting or presentation format the ability to follow procedures used to process, classify, and grade cheese, attending to appropriate ratios and units.

4. Processing and Evaluation of Poultry, Eggs, and Fish

4.1 Breed and species**:** Identify major **poultry breeds utilized for meat and egg production**. Describe the fabrication, processing, packaging, and quality determination of poultry meat and eggs.

4.2 Inspection and grading: Outline the United States Department of Agriculture (USDA) **inspection procedures and system for classes, standards, and grades of poultry products**. Perform the evaluation and grading of carcasses and parts of chickens and turkeys, pre-cooked, further processed, and poultry meat products, providing written and

oral justification for evaluation and grading scores. Evaluate and grade eggs for interior and exterior quality and provide written and oral justification for evaluation conclusions.

4.3 Breed and species**:** Identify major **fish, shellfish, and crustaceans (seafood) consumed in the US**. Describe the fabrication, processing, packaging, and quality determination of each type of seafood.

4.4 Inspection and grading: Outline the Food and Drug Administration (FDA) **inspection procedures and system for classes, standards, and grades of seafood products**. Perform the evaluation and grading of seafood, providing written and oral justification for evaluation and grading scores. Evaluate and grade seafood products and provide written and oral justification for evaluation conclusions.

4.5 Processing: Compare and contrast the **carcass preparation and fabrication procedures for poultry and seafood**, addressing procedures specific to equipment, safety, sanitation, and quality control.

5. Processing and Evaluation of Vegetables, Fruits, and Nuts

5.1 Processing, packaging, and quality: Explain the **processing, packaging, and quality analysis of vegetables, fruits, and nut products**. Explain the use of various monitoring systems to appraise food quality, such as the Brix scale and USDA grade standards.

5.2 By-products: Describe **preparation and processing procedures for vegetables, fruits, nut by-products**, addressing procedures specific to equipment, safety, sanitation, and quality control.

6. Food Product Packaging and Labeling

6.1 Packaging and labeling: Identify **laws regulating the packaging and labeling of food products** and summarize industry requirements. Perform packaging and labeling procedures for different food products.

6.2 Storage and transportation: Research **storage and transportation issues pertaining to packaged food products** and the extent to which these issues affect safety and quality.

7. Food Product Marketing

7.1 **Marketing:** Explain the **fundamental economic principles such as supply, demand, and profit to the food science industry**. Describe marketing considerations and methods of merchandising food products. Discuss how quality, yield, and grade factors affect product marketing.

7.2 Blockchain: Compare and contrast various **blockchain technologies used in the food science** industry. Articulate how these technologies are changing, and how foods are produced and marketed in the United States and globally.

8. Consumer Issues

8.1 Consumer interest, trends, and satisfaction: Assess the **impact of organic, natural, ethnic, religion-based, and other specialized processing methods** in the food industry. Compare and contrast the advantages and disadvantages of value-added and specialty products. Evaluate and summarize **consumer interests, trends, and satisfaction as related to these products i**ncluding the impact of product recalls.

8.2 Product development process: Investigate the **food product development process**. Evaluate the use of **food batch procedures** for the purpose of economic efficiency. Describe the application of **sensory evaluation methods** to test food product flavor, appearance, and texture by quantitative description and simple difference testing.

8.3 Consumer concerns: Identify **consumer concerns related to food quality and safety,** (such as antibiotic use, genetically modified organisms (GMOs), pesticide use, and food-borne illnesses), and discuss the economic implications of low-quality and unsafe foods entering the market.

8.4 Industry response to changing consumer demand: Investigate the **implications of changing consumer demand on the food production industries**. Include issues such as demand for reduced calories, reduced fat, removal of specific fats, carbohydrates, or other ingredients, and preservatives

Standards Alignment Notes

References to other standards include:

- SAE: Supervised Agricultural Experience: All Agriculture students are encouraged to participate in a Supervised Agricultural Experience program to practice and demonstrate the knowledge and skills learned in their agriculture courses.
- AFNR: National Agriculture, Food, & Natural Resources (AFNR) Career Cluster Content Standards: Students engaged in activities outlined above should be able to demonstrate fluency in Standards ABS, CS, and FPP at the conclusion of the course.
- P21: Partnership for 21st Century Skills Framework for 21st Century Learning
    - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.