FOOD SCIENCE & TECHNOLOGY

****Even Years the event will be held at OSU**
****Odd Years the event will be held at EOU**

The Food Science and Technology Career Development Event (CDE) requires students to have an in-depth understanding of food product development, food presentation and food safety issues. Participants also use their sensory skills to solve problems and make sound decisions.

Students in this event participate in both team and individual activities. As a team, students respond to a product development scenario describing the need for a new or redesigned product that appeals to a potential market segment. The team's task is to design a new food product or reformulate an existing product based on information contained within the product development scenario. The team also completed a food safety and sanitation activity. As individuals, an objective test, a problem solving practicum and a food safety practicum are completed to count towards the team score.

This event reaches students in an area of agriculture that's continuing to grow in all aspects. By exposing students to issues in food science and technology, students gain experience that prepares them for traditional and non-traditional careers.

RULES AND REGULATIONS

1. Chapters are limited to one team per chapter. This career development event will be a **four-person team activity**. All team members will participate in all of the activities.

2. The food science and technology career development event will consist of four activities, 1) an objective test, 2) a team product development project, 3) a practicum in food safety and quality, and 4) a practicum in sensory evaluation.

3. This career development event will involve 2400 total points per team. The team product development project will be worth 400 points per team, the objective test will be worth 200 points and practicum will be worth 300 points per member.

4. Should a tie occur in the overall team placing, the tie will be broken by the highest team product development project score. If this score does not break the tie, then the highest number of total points earned from the objective test (adding all four team member scores) will break the tie, a third tie breaker will use the judges response to the Team Question period from the Team Product Development project, if it is necessary. To identify the high individual for this event in case of a tie, the highest examination score will be used as the first tie breaker, followed by the highest Food Safety and Quality practicum score, as the second tie breaker.

5. Allergy Information: Food products used in this event may contain or come in contact with potential allergens. Advisors must submit a special needs request form for participants with any allergies with certification. The event committee will make all reasonable efforts to accommodate students with food allergies.

EVENT FORMAT

TEAM PRODUCT DEVELOPMENT PROJECT

This project is a team activity. Each team will receive a marketing scenario describing a need for a new or redesigned product that would appeal to a potential market segment. This scenario will contain a description of the existing marketing situation, competition and potential target market segment to be served by the new product. It is the task of the team to design a new or reformulated food product or reformulate an existing product. The team will be responsible for understanding and using the following concepts:

- Formulation of product to meet specified market requirements
- New package design to reflect the developed product
- Nutritional label development
- Equipment used to formulate the product
- Address any potential quality control and assurance issues

Each team will be provided with package materials, ingredients, materials necessary for each ingredient group to be included on the label.

The team will have thirty (30) minutes to respond to the marketing scenario and reformulate or develop a new product and develop the front or principal display panel to reflect the new product and its market. After this time period, each team member will be expected to participate in a ten (10) minute oral product development proposal. In addition, there will be a five (5) minute question period in which each team member will be expected to answer a question and one general question addressed to the team.
Total time involved for each team will be 45 minutes. Total number of points possible for this activity will be 400 points.
Possible Products -

Ready-to-Eat Breakfast Cereal
Breakfast Bars
Candy
Beverages (Sports Drinks)
Processed Fruit Snacks
Stir-Fried Vegetables
Sandwich (RTE)

EVALUATION CRITERIA

Product Development Presentation

- Package Design 100 points
  - Use, development and adaptation of nutritional label
  - Use and development of the ingredient statement on educational panel
  - Use of principle display panel to convey information

- Oral Proposal 200 points
  - How does the product meet market needs?
  - How does the product address target audience?
  - The presentation should address the following product concerns:

Economics	Equipment	Nutrition	Packaging
Quality Control	Formulation	Health	Food Safety

- Response to judge's questions 100 points
  - Team Participation in Question Response
  - Quality of Response

Total	**400 points**

Objective Test
The objective questions administered during the Food Science and Technology examination will be designed to determine each team member's understanding of the basic principles of food science and technology. It will encompass the knowledge required of the team event and the two practicum's, i.e. food safety and quality and sensory evaluation, as well as test a participant's knowledge of the equipment used to manufacture the theme product and product nutritional analysis.

Team members will work individually to answer each of the 40 questions. Each team member should provide a pencil. Each person will have fifty minutes to complete the examination. Each question will be worth 5 points for a correct answer. The test will come from the last three years of national tests.

No programmable calculators will be allowed to be used during this career development event.

PRACTICUMS
Each team member will compete in four practicums. The practicums will be worth 300 points. Each participant must bring a pencil and a clipboard for this portion of the event.

Food Safety and Quality Practicum
Customer Complaint Letter
Each participant will be given five scenarios representing general consumer inquiries. Participants must determine if the consumer inquiry reflects a quality or safety issue (four points per scenario) and

determine if it is a biological, chemical or physical concern or hazard (six points per scenario). This is for a total of 50 points.

Food Safety/Sanitation

Each participant will be given ten (10) photos of potential food safety and or sanitation problems. A numbered list of problems will also be provided at the beginning of this practicum segment. The list will contain more potential problems than the number of photographs. Identify the type of problem in the photo sheet by recording the number from the list on the sheet provided to each participant. Each participant will start at a station to view a photograph and record an answer. After one minute, the participants will be told to move to the next station. This will continue until each participant returns to his or her original station. Each photo will be worth 5 points each for a total of 50 points.

Food Safety & Quality Practicum Scorecard

Customer Complaint Letter …….. 50 points

Food Safety and Sanitation Problem Identification……. 50 points

Total Point …….. 100 points

Sensory Evaluation

Each participant will be asked to identify ten different aromas from containers provided at each station and record the answer on the sheet provided. A list of potential aromas will be provided to each person. Each station is worth 10 points.

Scent FAQ: https://drive.google.com/open?id=1u6jrK08tSBcoXngC_bIxtkOoV-vBQKFx
Scent Order Form: https://drive.google.com/open?id=1HhWNE8ICKm9jRQde5WQhlzqq4SveSsKb
www.flavor.education

Two sets of three different triangle tests will be conducted. Participants are expected to identify the different samples through flavor, aroma, visual cues or textural differences. Answer spaces will be given on the sheet provided. No list will be provided for this segment of the practicum. Each set of three samples is worth 50 points for a total possible of 100 points.

Food Safety and Sanitation Problem Identification……. 50 points

Customer Complaint Letter……..… 50 points

Aroma Identification……. 100 points

Difference Testing and Triangle Test …… 100 points

Total Points…….. 300 points

TIEBREAKERS

Team:

1. Team product development
2. Team food safety/sanitation
3. Individual test (combined score)

Individual:

1. Written exam
2. Food safety and quality
3. Sensory evaluation

Reference Material:

Food Science, Safety and Nutrition - a special project from the National Council of Agricultural Education. Delmar and Interstate texts from national list.

Food Processing Equipment List

Adhesive Applicator—applies bonding materials to labels, containers and cartons.

Aerator—incorporates air chemically or mechanically in various food products.

Air Compressor—supplies air under pressure for temperature control, agitation and lift equipment.

Air Curtain—provide air flow across doorways to reduce refrigerated air losses and control pests.

Aseptic Processing System—a continuous thermal sterilization process and aseptic packaging for preserving foods.

Bar Code Printer/Applicator—a system of coding products for computer readout to improve inventory control, pricing, and manufacturing schedules.

Batter & Breading Machines—to apply coatings of dough and bread crumbs to foods.

Blancher—immerses food in hot water or exposes them to live steam, hot gases, or microwave enzymes, set or fix color, and remove air and undesirable odors.

Bowl Chopper—rotating bowl with sharp knives for cutting raw meat into smaller pieces or into ground emulsions.

Box Making Machinery—forms food cartons from various types of paper.

Can Closing and Sealing Machines— removes residual air from surface of foods filled into metal containers, applies lid, and seals the lid to the container.

Capping Machine— removes residual air from surface of foods filled into bottles or jars, applies cap, and seals the cap to the container.

Carton Handling Machine—(Forming, Filling and Closing)

Clean-in-Place Systems (CIP)—fluid cleaning materials are held in tanks and re-circulated under pressure through pipelines around the plant or within a specific equipment system.

Coder, Dater and Imprinter—applies identifying numbers, letters, or marks to foods or containers to indicate to the producer or consumer, the product date of manufacture and/or usage or freshness dates.

Conveyer—mechanical devices used to assist in the movement of ingredients, food products or packaging supplies.

Cutting Machine, Dicer, Flaker, Slicer— reduces or changes size, volume, or shape of raw food materials.

Dough~Proofer—enclosed room or cabinet with controlled environment (temperature, humidity) used for final fermentation step prior to baking to allow dough to warm up and accelerate production of carbon dioxide by yeast (rising).

Dryer—use of forced hot air, dehydro-freezing or freeze-drying for removal of moisture from foods for purposes of preservation, texture improvement, weight reduction, or cost savings.

Enrober—coats food products, generally by dipping or flowing liquid coating over the product (such as chocolate or candy).

Evaporator—removes water from raw food materials as a first step to drying

Extractor/Presse—for separation of solids and liquids

Stuffer—device for holding quantities of meat emulsions (or other extrudable products) and pressurized extrusion through a die into a finished food package.

Thermometer—instruments for measuring temperatures.

Food Laboratory Equipment List

Abbe refractometer—used to measure the refractive index of compounds; for example, used to measure the soluble solids of juices.

Accelerated Shelf Life Chamber—chambers set at various temperatures to conduct accelerated shelf life testing.

Adhesive Bond Test Equipment—measures adhering strength of sealants or glues.

Autoclave—heated chamber for sterilization of equipment & microbiological media.

Automatic Colony Counter—for laser counting of mold colonies grown on Petri dishes.

Balance—analytical, top-loading device for measuring weight.

Brabender Amylograph—records changes in viscosity of starch under controlled temperatures and stirring used in baking and food processing industries to measures starch characteristics.

Centrifuge—instrument that rotates at very high speeds allowing the separation of compounds.

Colony Counter—used to count mold colonies on a Petri dish.

Color Measuring Instruments (Laboratory or Portable)—color, an important attribute of foods, may be measured with a variety of instruments:
Colored blocks or chips - used to compare with products.
Hunter color difference meter - provide standardized objective measurement of food color.
Spectrophotometers- (see separate listing)

High Pressure Liquid Chromatograph (HPLC)—measures level of the separation of mixtures into individual components by passing a liquid or gas along a stationary material such as paper or gels. One example of its use in the food industry is to determine flavor compounds in coffee.

Hot Plate—a flat portable electric heating unit.

Impulse Sealor—seals seasoning pouches or plastic bags for send out or sample storage

Incubators—heated chamber used for storage of Petri dishes & culture to grow microorganisms.

Impedance Monitoring System—rapid method for determining the number of microorganisms in a sample.

Kjeldahl Method—laboratory equipment and technique for determining nitrogen content of food samples (mostly grains) to calculate the protein percentage.

Laboratory Glassware—a variety of sizes of beakers, tubes, pipettes, dishes and covers used for running tests and other products.

Luminometer—instrument for instantaneously determining sanitation of food handling equipment.

Microscope—an optical instrument consisting of lenses for making enlarged images of minutes objects.

Petri Dish—glass or disposable plastic plates or dishes for growing microbiological cultures.

pH Meter—measure the hydrogen ion concentration of foods and determines if a food is acidic or basic. pH is an important basic attribute of foods.

Pipette—glass or disposable plastic tubes for siphoning or adding small-measured amounts of liquids.

Refrigerator -Freezer—to store microbiological cultures and keep samples.

Rotap—sieve analysis of ingredients.

Safety Hood—to handle hazardous cultures and/or food samples usually containing an exhaust fan.

Salmonella Testing Kit—measures a pathogenic bacteria which causes food poisoning.

Scale—measures weights of ingredients for testing.

Shear Press—instrument that pushes a metal probe through a food sample, gives an indication of how tough a food is.

Spectrophotometer—measures the light, energy absorption by food samples. This instrument is used of determining such attributes as lactose in milk. Near-infrared spectroscopy provides quantitative determination of moisture, fat, protein, and sugar contents of a wide variety of foods.

Spiral Plater—laboratory equipment for a rapid method of preparing Petri dishes to enumerate microorganisms in foods.

Stomacher Blender—blender that utilizes sterile plastic bags & paddles to macerate a sample.

Testing Kit—self-contained units that include all the materials to test foods for either microorganisms (for example, salmonella, E. coli), pesticides, or toxicants (alfatoxins).

Thermometer—basic instrument in the food laboratory used to measure the heat of a food sample. Various types include liquid thermometers and thermocouples.

Titrator—are used to measure the concentration of components of a solution. For example, titration may be used to measure the amount of malic acid in apple juice or the salt in seasonings.

Vacuum Oven—vacuumized chamber for drying samples for moisture analysis.

Water Activity Meter—measures water activity for shelf life testing.

Water Bath—for incubation or storage of melted media.

Sensory Evaluation – Aromas

1. Cinnamon
2. Peanut Butter
3. Chocolate
4. Maple
5. Oregano
6. Basil
7. Lemon
8. Lime
9. Orange
10. Vanilla
11. Almond
12. Smoke (liquid)
13. Cherry
14. Pine
15. Onion
16. Butter
17. Menthol
18. Grape
19. Garlic
20. Peppermint
21. Clove
22. Nutmeg
23. Ginger
24. Molasses
25. Wintergreen
26. Banana
27. Coconut
28. Lilac
29. Raspberry
30. Strawberry
31. Licorice (anise)

Package Design	**Possible Score**	**Team Score**
• Use and development of nutrition label		
o Required information present	**10**	
o Correct calculations	**10**	
o Correct organization	**10**	
• Use and development of the ingredient statement		
o Present	**10**	
o Correct order and all ingredients included	**10**	
o Location on package	**10**	
• Use of principle display panel to convey information		
o All required components	**15**	
o Correct information	**15**	
o Location on package	**10**	
Package Design Subtotal	**100**	
Product Development Oral Presentation	**Possible Score**	**Team Score**
• Cost of Goods Sold o Costing o Accuracy	**15**	
• Nutrition o Communicate nutritional quality of product o Apply nutritional quality to health benefits	**15**	
• Target Audience ○ Identification of key consumer	**15**	
• Quality Control o Key quality attribute of consistent product o Examples: Flavor, color, texture, net weight, size, etc.	**15**	

• Marketing & Sales o Communicated with future users o Promotions o Market location	**15**	
• Product o App earance o Texture o Shelf-life o Interaction of ingredients oCreativity	**15**	
• Processing o Description of how to make product o Equipment o Flow diagram, unit operations o People	**15**	
• Packaging o Materials used o Appropriate for use of product o Creativity	**20**	
• Food Safety o Discussed potential hazards/concerns associated with products	**20**	
• Formulation Concepts		
o How well did product match concept/product development scenario	**15**	
o Category	**5**	
o Platform	**5**	
• Quality of Presentation		
o Equitable participation of team members	**5**	
o Organization	**5**	
o Use of time allowed	**5**	

o Professionalism	**5**	
o Presence & enthusiasm	**5**	
o Mannerisms	**5**	
Product Development Oral Presentation Subtotal	**200**	
Response to Judges' Questions	**Possible Score**	**Team Score**
• Team Participation in Question Response o All team members contributed	**50**	
• Quality of Response o Accuracy o Ability to answer o Originality o Knowledge	**50**	
Response to Judges' Questions Subtotal	**100**	
TOTAL POINTS	**400**	

Oregon Food Science CDE
Sensory Analysis

Contestant Name: _____

Place the number of the Aroma sample on the line corresponding to your selection of its correct common name. 100 points (10 points each)

. _____ Cinnamon	**. _____ Menthol**
. _____ Peanut Butter	**. _____ Grape**
. _____ Chocolate	**. _____ Garlic**
. _____ Maple	**. _____ Peppermint**
. _____ Oregano	**. _____ Clove**
. _____ Basil	**. _____ Nutmeg**
. _____ Lemon	**. _____ Ginger**
. _____ Lime	**. _____ Molasses**
. _____ Orange	**. _____ Wintergreen**
. _____ Vanilla	**. _____ Banana**
. _____ Almond	**. _____ Coconut**
. _____ Smoke (liquid)	**. _____ Lilac**
. _____ Cherry	**. _____ Raspberry**
. _____ Pine	**. _____ Strawberry**
. _____ Onion	**. _____ Licorice (anise)**
. _____ Butter	

Triangle Test

Instructions:

In front of you are 3 sets of 3 coded perishable samples, two of them are the same and one is different within each set. Starting from the left, please evaluate the samples and circle the sample code that is DIFFERENT from the other two. You may re-taste the samples.

Once you have identified the different sample for Sample 1, proceed to the samples for sample 2, and then the samples 3.

Sample 1

_____ _____ _____

Sample 2

_____ _____ _____

Sample 3

_____ _____ _____

Please return your ballot to the server as you leave the booth area. Thank you!

Oregon FFA Food Science

Food Safety and Quality Practicum
Customer Complaint Letter

Contestant Name _____

Assume you are responsible for Food Safety and Food Quality at a major Food Company. You have 15 minutes to study the letter and answer the questions below. After reading the **Complaint Letter, answer** the following questions.

Question #1: **Does the complaint indicate a (4 points)** **(Check only one)**

FOOD SAFETY PROBLEM? 1a _____

- **or** – a **FOOD QUALITY PROBLEM**? 1b _____

Question #2: **Is the problem primarily (6 points)** **(Check only one)**

- Biological 2a _____
- Chemical 2b _____
- Physical 2c _____
- None of the above 2d _____

Food Science CDE
Difference Testing Evaluation

(Aroma, Visual, or Textural)

Contestant Number _____

Place an "X" on the line of the sample which is different from the other samples. You may need to smell, visually appraise, analyze texture, etc. to determine the different sample. **15 points per sample - 45 points total.**

Sample A

A ____ B ____ C ____

Sample B

A ____ B ____ C ____

Sample C

A ____ B ____ C ____

Oregon Food Science CDE
Food Safety and Sanitation Problem Identification
(50 points - 5 points each – 10 minutes)

Contestant Name: _____

Each team member will individually observe 10 photos of different processing operations, which **may or may not** show **one or more** actual or potential food safety and/or sanitation problem(s). Observe and write your answers. In the first question of each photo, you must **circle** only one answer (YES or NO).

Photo	Question 1 – 2 points	Question 2 – 3 points
1	The food company should be cited by food inspectors for Sanitation and/or Food Safety problem(s). YES NO	If YES list number(s) that apply (max. 2) from guidelines a b
2	The food company should be cited by food inspectors for Sanitation and/or Food Safety problem(s). YES NO	If YES list number(s) that apply (max. 2) from guidelines a b
3	The food company should be cited by food inspectors for Sanitation and/or Food Safety problem(s). YES NO	If YES list number(s) that apply (max. 2) from guidelines a b
4	The food company should be cited by food inspectors for Sanitation and/or Food Safety problem(s). YES NO	If YES list number(s) that apply (max. 2) from guidelines a b
5	The food company should be cited by food inspectors for Sanitation and/or Food Safety problem(s). YES NO	If YES list number(s) that apply (max. 2) from guidelines a b
6	The food company should be cited by food inspectors for Sanitation and/or Food Safety problem(s). YES NO	If YES list number(s) that apply (max. 2) from guidelines a b
7	The food company should be cited by food inspectors for Sanitation and/or Food Safety problem(s). YES NO	If YES list number(s) that apply (max. 2) from guidelines a b
8	The food company should be cited by food inspectors for Sanitation and/or Food Safety problem(s). YES NO	If YES list number(s) that apply (max. 2) from guidelines a b
9	The food company should be cited by food inspectors for Sanitation and/or Food Safety problem(s). YES NO	If YES list number(s) that apply (max. 2) from guidelines a b
10	The food company should be cited by food inspectors for Sanitation and/or Food Safety problem(s). YES NO	If YES list number(s) that apply (max. 2) from guidelines a b

LIST OF POTENTIAL FOOD PROCESSING OPERATIONS SANITATION & FOOD SAFETY PROBLEMS

1. Facilities, ingredients and packaging supplies, and processed foods shall be free of:
   a. Insects (such as flies, cockroaches, worms, etc), insect parts (in excess of allowable limits), and insect eggs
   b. Rodents (such as rats & mice)
   c. Birds
   d. Domestic Animals (such as Cats & Dogs)
   e. Fecal droppings or urinary discharges from any of the above
2. Hole in walls or window screens are not permitted (as they may allow entry of insects or rodents)
3. Cracks or spacing under doors or windows are not permitted
4. Open outside doors or windows without screens or air curtains are not permitted
5. Rodent control programs are required (including traps or baits)
6. Open-top trash containers (inside or outside) are required to be covered
7. Rust, rough solder and seams on processing equipment contacting foods are not allowed
8. Proper temperature control of processes throughout the facility is required, such as:
   a. Cooler storage temperatures
   b. Freezer storage temperatures
   c. Frozen ingredients may be thawed prior to use, but containers cannot be dripping moisture or other liquids prior to usage
9. Equipment, facilities, walls and floors, and overhead utilities must be dirt, dust, mold, or otherwise contamination-free
10. Equipment or utilities above the processing line shall not drop anything into the food line (such as grease, water, dust, or dirt on equipment or food)
11. All parts of a disassembled processing equipment line shall be cleaned immediately after usage and stored on clean racks (off floor) when not in use (Any contact with floor shall be considered re-contamination)
12. All food contact surfaces shall be constructed of heavy stainless steel, or of food grade quality sanitary plastic or rubber
13. All overhead lights shall be shielded to avoid glass breakage and contamination of foods
14. All processing cooking vessels shall be covered whenever possible, to prevent contamination and control temperatures
15. All processing room walls shall be constructed of washable, waterproof material
16. All raw ingredients shall be sound and wholesome
17. Food handling employees must wear hairnets and/or beard nets
18. Food employees must not touch ready-to-eat foods with their bare hands
19. Food handling employees must wash their hands prior to starting work, after picking up anything from the floor, after every visit to the toilet or at any other time whereby their hands may have become contaminated

20. Food handling employees shall wear clean, impact-resistant, sanitary gloves made of impermeable plastic or rubber whenever in direct contact with foods, ingredients or containers for these foods and supplies
21. All hand-wash sinks in food operation and toilet areas shall be clean and sanitary, with cold & hot water and proper temperature controls and mixing valves and accessible at all times
22. Hand wash sinks and equipment wash sinks shall not be used to store soiled or clean equipment, supplies, or packaging containers.
23. Adequate covered trash containers must be available in food operation, toilet and hand-wash sink areas
24. Processed foods shall not contain any foreign materials (such as glass, metal, wood, insects or parts of insects, or toxic substances)
25. Only government approved and properly labeled chemicals may be used for cleaning the processing equipment and plant work areas
26. Only government approved chemicals may be used for maintaining the food plant and storage areas from contamination by insects, rodents, birds, etc, and shall be applied by a certified pest control operator
27. Workers with open cuts, bruises, or wounds shall not handle foods or raw
28. Ingredients and workers shall be free of any disease that can be communicable through food or equipment
29. Uncooked foods and cooked foods shall be stored in separated areas with proper identification
30. All processed food products offered for public sale and consumption shall be sound and wholesome and free of adulterants
31. All walls, ceilings, floor, and equipment exposed to foods in the processing or storage areas shall be rust-free
32. All packaging materials, equipment, or storage and delivery supplies must be free of dust, dirt, rust, or other possible contaminants
33. All food ingredients to be added to foods and/or processed for human consumption must be clean and free from any contact with contaminated surfaces prior to usage

ALIGNMENT TO AFNR CONTENT STANDARDS & OREGON EMPLOYABILITY SKILLS

- Employability 01. Adhere to workplace practices
- Employability 02. Exhibit personal responsibility and accountability
- Employability 03. Practice cultural competence
- Employability 04. Demonstrate teamwork and conflict resolution
- Employability 05. Communicate clearly and effectively
- Employability 06. Employ critical thinking to solve problems
- Employability 07. Demonstrate creativity and innovative thinking
- Employability 08. Demonstrate fluency in workplace technologies
- Employability 09. Plan, organize, and manage work
- Employability 10. Make informed career decisions
- ABS.01.03 Devise and apply management skills to organize and run an AFNR business in an efficient, legal and ethical manner.
- ABS.02.02 Assemble, interpret and analyze financial information and reports to monitor AFNR business performance and support decision-making (e.g., income statements, balance sheets, cash-flow analysis, inventory reports, break-even analysis, return on investment, taxes, etc.).
- ABS.04.01 Analyze characteristics and planning requirements associated with developing business plans for different types of AFNR businesses.
- ABS.04.02 Develop production and operational plans for an AFNR business.
- ABS.05.02 Assess and apply sales principles and skills to accomplish AFNR business objectives.
- ABS.05.03 Assess marketing principles and develop marketing plans to accomplish AFNR business objectives.
- BS.01.01 Investigate and explain the relationship between past, current and emerging applications of biotechnology in agriculture (e.g., major innovators, historical developments, potential applications of biotechnology, etc.).
- BS.01.02 Evaluate the scope and implications of regulatory agencies on applications of biotechnology in agriculture and protection of public interests (e.g., health, safety, environmental issues, etc.).
- BS.02.02 Implement standard operating procedures for the proper maintenance, use and sterilization of equipment in a laboratory.
- BS.02.04 Safely manage and dispose of biological materials, chemicals and wastes according to standard operating procedures.
- BS.02.05 Examine and perform scientific procedures using microbes, DNA, RNA and proteins in a laboratory.
- BS.03.02 Apply biotechnology principles, techniques and processes to enhance the production of food through the use of microorganisms and enzymes.
- BS.03.03 Apply biotechnology principles, techniques and processes to protect the environment and maximize use of natural resources (e.g., biomass, bioprospecting, industrial biotechnology, etc.).
- BS.03.05 Apply biotechnology principles, techniques and processes to produce biofuels (e.g., fermentation, transesterification, methanogenesis, etc.).
- CRP.02.01 Use strategic thinking to connect and apply academic learning, knowledge and skills to solve problems in the workplace and community.
- CRP.02.02 Use strategic thinking to connect and apply technical concepts to solve problems in the workplace and community.
- CRP.04.02 Produce clear, reasoned and coherent written and visual communication in formal and informal settings.
- CRP.04.03 Model active listening strategies when interacting with others in formal and informal settings.

- CRP.05.01 Assess, identify and synthesize the information and resources needed to make decisions that positively impact the workplace and community.
- CRP.05.02 Make, defend and evaluate decisions at work and in the community using information about the potential environmental, social and economic impacts.
- CRP.06.01 Synthesize information, knowledge and experience to generate original ideas and challenge assumptions in the workplace and community.
- CRP.06.03 Create and execute a plan of action to act upon new ideas and introduce innovations to workplace and community organizations.
- CRP.07.01 Select and implement reliable research processes and methods to generate data for decision-making in the workplace and community.
- CRP.08.01 Apply reason and logic to evaluate workplace and community situations from multiple perspectives.
- CRP.09.03 Demonstrate behaviors that contribute to a positive morale and culture in the workplace and community (e.g., positively influencing others, effectively communicating, etc.).
- CRP.10.02 Examine career advancement requirements (e.g., education, certification, training, etc.) and create goals for continuous growth in a chosen career.
- CRP.11.01 Research, select and use new technologies, tools and applications to maximize productivity in the workplace and community.
- CRP.11.02 Evaluate personal and organizational risks of technology use and take actions to prevent or minimize risks in the workplace and community.
- CRP.12.01 Contribute to team-oriented projects and builds consensus to accomplish results using cultural global competence in the workplace and community.
- CRP.12.02 Create and implement strategies to engage team members to work toward team and organizational goals in a variety of workplace and community situations (e.g., meetings, presentations, etc.).
- CS.01.01 Research, examine and discuss issues and trends that impact AFNR systems on local, state, national and global levels.
- CS.01.03 Identify public policies and examine their impact on AFNR systems.
- CS.02.01 Research and use geographic and economic data to solve problems in AFNR systems.
- CS.02.02 Examine the components of the AFNR systems and assess their impact on the local, state, national and global society and economy.
- CS.03.01 Identify and explain the implications of required regulations to maintain and improve safety, health and environmental management systems.
- CS.03.03 Apply health and safety practices to AFNR workplaces.
- CS.03.04 Use appropriate protective equipment and demonstrate safe and proper use of AFNR tools and equipment.
- CS.05.01 Evaluate and implement the steps and requirements to pursue a career opportunity in each of the AFNR career pathways (e.g., goals, degrees, certifications, resumes, cover letter, portfolios, interviews, etc.).
- FPP.01.01 Analyze and manage operational and safety procedures in food products and processing facilities.
- FPP.01.02 Apply food safety and sanitation procedures in the handling and processing of food products to ensure food quality.
- FPP.01.03 Apply food safety procedures when storing food products to ensure food quality.
- FPP.02.01 Apply principles of nutrition and biology to develop food products that provide a safe, wholesome and nutritious food supply for local and global food systems.
- FPP.02.02 Apply principles of microbiology and chemistry to develop food products to provide a safe, wholesome and nutritious food supply for local and global food systems.

- FPP.02.03 Apply principles of human behavior to develop food products to provide a safe, wholesome and nutritious food supply for local and global food systems.
- FPP.03.01 Implement selection, evaluation and inspection techniques to ensure safe and quality food products.
- FPP.03.02 Design and apply techniques of food processing, preservation, packaging and presentation for distribution and consumption of food products.
- FPP.03.03 Create food distribution plans and procedures to ensure safe delivery of food products.
- FPP.04.01 Examine the scope of the food industry by evaluating local and global policies, trends and customs for food production.
- FPP.04.02 Evaluate the significance and implications of changes and trends in the food products and processing industry in the local and global food systems.
- FPP.04.03 Identify and explain the purpose of industry organizations, groups and regulatory agencies that influence the local and global food systems.