Course Title	Agri-Science II
Department and Curriculum Writing Team Members	Agri-Science & Technology: Karolyn Jordan Laura Manzi-Smith Devon O'Keefe Matthew Smith Robert Williams
Course Overview	Agri-Science II students continue to work with introductory units building on basic skills learned in Agri-Science I. During the first semester the students will be exposed to units in animal science, horticulture, natural resources and agricultural mechanics. By the end of second semester Agri-Science II students will have developed a far better understanding of agriculture and will be able to make informed decisions about the choices of classes that best suit their career interests and needs for their semester 2 courses. Students work with their SAE advisors to determine the best course of study.
Length of Course	☑ Full year ☐ Semester
Type of Course	☐ Humanities Required Credit ☐ STEM Required Credit ☐ Humanities Elective Credit ☑ STEM Elective Credit ☐ PE/Health Required Credit ☐ Other
Grade Level	☐ 9 ☑ 10 ☐ 11 ☐ 12
Prerequisites	Agri-Science I

Approved by Instructional Council on May 31, 2023

Ledyard High School Vision of the Graduate	Ledyard High School is a learning community dedicated to the cultivation of skills essential for our students' success in a rapidly-evolving society. At Ledyard High School, we believe our graduates should demonstrate the following: ☑ Collaboration - Colonel Graduates will demonstrate an ability to work effectively with others, sharing ideas, acknowledging one another's strengths, and collaborating to produce presentations, projects, performances, or events. ☑ Communication- Colonel Graduates will demonstrate an ability to communicate information clearly and effectively through a variety of media, including written, oral, visual, musical, and/or video productions. ☑ Problem-Solving- Colonel Graduates will demonstrate an ability to solve problems of varying complexity across a variety of content areas. ☑ Critical Thinking - Colonel Graduates will demonstrate critical thinking skills to find solutions, support arguments, and overcome challenges in a variety of content areas. ☑ Perseverance - Colonel Graduates will demonstrate perseverance in academic and extracurricular settings by working through and past obstacles in pursuit of goals. ☑ Creativity - Colonel Graduates will demonstrate creativity through their participation in fine arts courses as well as through their inventive approaches to learning activities in a variety of settings.
VOG Portfolio Component	N/A

Ledyard Agri-Science & Technology Program

Agri-Science II Curriculum

Approved by Instructional Council on May 31, 2023

Agri-Science II

Agri-Science II students continue to work with introductory units building on basic skills learned in Agri-Science I. During the first semester the students will be exposed to units in animal science, horticulture, natural resources and agricultural mechanics. By the end of second semester Agri-Science II students will have developed a far better understanding of agriculture and will be able to make informed decisions about the choices of classes that best suit their career interests and needs for their semester 2 courses. Students work with their SAE advisors to determine the best course of study.

Required Units-Semester 1

Supervised Agricultural Experience (SAE)
Animal Health
Greenhouse Crop Production
Natural Resources
Shop Safety

Pathway Units-Semester 2

Approved by Instructional Council on May 31, 2023

Course Title	Supervised Agricultural Experience (SAE)
Agriculture Pathway	All agricultural pathways
Length of Course	On-Going
Ledyard High School Expectations for Student Learning	Read and write critically and effectively for a variety of purposes Communicate information clearly and effectively in a variety of settings Demonstrate critical thinking and problem solving skills effectively Employ effective research and study skills Demonstrate independence and self-reliance
Course Overview	SAE is a vital aspect of agricultural education. During Agri-Science I students begin to develop a plan for supervised work experience relating to their interests and career goals. All Agri-Science students must have an approved SAE program in place by July 1 at the start of the Agri-Science II year. SAE advisors work with individual students, parents, work-site mentors, and employers to ensure student activities are appropriate, meet student needs, and are in compliance with state labor laws. All students work with their SAE advisors to complete the Universal Structured Work-Based Learning Plan. In addition, some students must complete the Connecticut Department of Labor forms LED 75-1 (Workplace Learning Experiences for Minor Students in Hazardous Occupations) or the LED 31-23 (Workplace Learning Experiences for Minor Students Ages 14 or 15 in Non-Hazardous Occupations), or Unpaid Work Experience forms.
Units of Study	1. Develop an Approved Supervised Agricultural Experience (SAE) Program 2. Record Keeping 3. Employability Skills

Unit 1	Develop an Approved Supervised Agricultural Experience (SAE) Program
Essential Questions	1. What is an SAE and why is it important? 2. What are the benefits of gaining employability skills for career growth?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CRP.10.01.02.c. Match potential career opportunities in career clusters with personal interests, talents, goals and preferences. CRP.10.02.02.a. Identify methods for setting goals for personal improvement and continuous growth in a career area (e.g., SMART goals, training, professional development, etc.). CRP.10.03.02.a. Identify trusted individuals to consult with on setting and achieving career and personal goals (e.g., counselors, teachers, mentors, coaches, community leaders, etc.). CS.03.01.02.a. Summarize the importance of safety, health and environmental management in the workplace.
Common Core State Standards	WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience SL.11-12.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	CRP.04.02.01.a. Research and summarize the purpose of different forms of written and visual communication in formal and informal settings (e.g., letters, emails, reports, social media, graphics, diagrams, etc.). CRP.10.02.01.a. Categorize career advancement requirements for potential careers (e.g., degrees, certification, training, etc.). CS.03.03.04.c. Create a plan to mitigate the level of contamination or injury identified as a risk in the workplace.
Common Core State Standards	RST.11-12.4 Determine the meaning of words and phrases as they are used in text, including analyzing how an author uses and refines the meaning of a key term over the course of a text.

Learning Objectives	Activities	CT AFNR, NGSS, CCSS
Identify local agricultural work experiences	● Research and identify local 501(c)3 non profit organizations ● Locate local agricultural businesses ● Determine qualifications needed for employment ● Call to inquire about agricultural position	CRP.04.02.01.a. CRP.10.02.01.a. CRP.10.03.02.a. SL.11-12.4 RST.11-12.4
Develop an appropriate SAE work experience	● Identify agricultural interests ● Develop work experience activities/projects in line with career goals ● Write SMART goals for SAE growth and improvement ● Obtain approval from parents/guardians and SAE advisor ● Meet with SAE advisor during the school year and at least once during the summer	CRP.10.01.02.c. CRP.10.02.02.a. CS.03.03.04.c. WHST.11-12.4 RST.11-12.4 SL.11-12.4
Complete appropriate work experience forms utilizing AFNR standards	● Identify key skills necessary to complete the Structured Work-Based Learning Form ● Complete appropriate CT Departments of Labor and Education forms for student work experience	CS.03.01.02.a. WHST.11-12.4 RST.11-12.4

Unit 2	Record Keeping
Essential Questions	1. Why is record keeping essential to an SAE experience? 2. Why is documenting SAE experiences beneficial to a student?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CRP.03.02.01.a. Research and examine components in a personal financial management plan (e.g., income, expense, budgeting, savings, credit, etc.). CRP.09.02.01.a. Identify and summarize personal management skills necessary to function effectively in the workplace (e.g., time management, planning, prioritizing, etc.). CRP.13.03.01.c. Apply for a chapter, state and national proficiency award that corresponds with an SAE program.
Common Core State Standards	RST.11-12.4 Determine the meaning of words and phrases as they are used in text, including analyzing how an author uses and refines the meaning of a key term over the course of a text. WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience MP4 Model with mathematics

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	ABS.02.02.01.a. Compare and contrast the different types of financial reports (e.g., income statements, cash flow statements, equity statements, etc.) and their frequency of use (e.g., daily, weekly, monthly, quarterly, annual) for monitoring AFNR business performance.
Common Core State Standards	MP6 Attend to precision

Objectives	Activities	CT AFNR, NGSS, CCSS
Develop and maintain SAE records	● Document time spent in SAE & FFA activities, skills learned, income, and expenses ● Utilize online record keeping program (AET) to document records ● Provide evidence of work using photographs, videos, and journals	CRP.03.02.01.a. CRP.09.02.01.a. ABS.02.02.01.a. RST.11-12.4 WHST.11-12.4 MP4
Apply for SAE and FFA awards	● Research SAE and FFA awards applicable to SAE experiences ● Calculate SAE hours worked, income and expenses ● Complete local, state, and national degree and award applications as applicable	CRP.13.03.01.c. RST.11-12.4 WHST.11-12.4 MP6

Unit 3	Employability Skills
Essential Questions	1. Why is it important to develop agricultural employability skills? 2. What types of skills are needed for an entry level agricultural position?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CRP.08.02.02.b. Apply decision-making processes to generate possible solutions to solve workplace and community problems. CRP.09.03.02.c. Model respectful and purposeful behaviors that contribute to positive morale and culture in the workplace and community (e.g., effectively communicating, recognizing accomplishments of others, etc.). CS.03.04.01.a. Identify and differentiate the appropriate protective equipment for the safe use and operation of specific tools and equipment (e.g. PPE, etc.). CS.03.04.02.a. Identify standard tools, equipment and safety procedures related to AFNR tasks. CS.03.04.03.a. Read and interpret operating instructions related to operation, storage and maintenance of tools and equipment related AFNR tasks. CS.05.01.03.a. Research and summarize specific tools (e.g., resumes, portfolios, cover letters, etc.) and processes (e.g., interviews, applications, etc.) needed to pursue a career in an AFNR pathway.
Common Core State Standards	WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience SL.11-12.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Supporting Standards

Connecticut Agriculture, Food, and	CRP.01.01.02.a. Distinguish personal levels of responsibility, which can be applied in the workplace and community. CRP.10.03.01.a. Summarize ways that input and/or advice from career area experts could assist in planning personal career

Natural Resources Standards	goals. CS.05.01.01.b. Create a personal plan outlining goals and steps to obtain a career in an AFNR pathway.
Common Core State Standards	RST.11-12.4 Determine the meaning of words and phrases as they are used in text, including analyzing how an author uses and refines the meaning of a key term over the course of a text.

Objectives	Activities	CT AFNR, NGSS, CCSS
Demonstrate effective and appropriate agricultural employability skills	● Work safely and effectively in an SAE experience ● Select and use appropriate PPE for SAE experiences ● Report broken, chipped or cracked PPE to manager ● Select and use appropriate tools and equipment for SAE experiences according to manufacturer's directions ● Maintain professionalism and confidentiality in the workplace ● Model listening and problem solving skills	CRP.01.01.02.a. CRP.08.02.02.b. CRP.09.03.02.c. CS.03.04.01.a. CS.03.04.02.a. CS.03.04.03.a. WHST.11-12.4 RST.11-12.4 SL.11-12.4
Demonstrate improvement and growth in career skills	● Provide evidence of work using photographs, videos, and journals ● Write an annual summary of activities ● Create quarterly and yearly SAE goals to grow or improve SAE experience ● Share SAE experiences to educate others about additional options for SAE projects	CRP.08.02.02.b. CRP.09.03.02.c. CRP.10.03.01.a. CS.05.01.01.b. WHST.11-12.4 RST.11-12.4 SL.11-12.4
Complete job application documents	● Research agricultural job openings ● Create a cover letter and a resume ● Complete a job application ● Participate in a job interview	CRP.09.03.02.c. CRP.10.03.01.a. CS.05.01.03.a. WHST.11-12.4 RST.11-12.4 SL.11-12.4

Vocabulary:

501 (c) 3
Community Service
Entrepreneurship
Expenses
Hazardous Occupations
Income
Liability
Non-Profit Entity
Paid Placement
Placement
SAE
Scope
Structured Work-Based Learning Plan
Volunteer
Work-site Mentor

Assessments:
Record checks
Annual summaries
On-site visits by advisor
SAE rubric

Connections to College/Career Readiness:
Hands-on agricultural skills and knowledge for job placement

Resources/Materials:

ASTE Standards
Online record keeping program- www.theaet.com
SDE/SDOL employment forms

Course Title	Animal Health
Agriculture Pathway	Animal Systems
Length of Course	Half a quarter
Ledyard High School Vision of the Graduate	Demonstrate an ability to work effectively with others, sharing ideas, acknowledging one another's strengths, and collaborating to produce presentations, projects, performances, or events. Demonstrate an ability to solve problems of varying complexity across a variety of content areas.
Course Overview	Students will learn and demonstrate safe animal handling practices. They will differentiate between species behaviors that influence effective handling techniques. Students will understand biosecurity and the differences between cleaning and disinfecting. Students will research zoonotic diseases and apply the knowledge to safe animal handling practices. Students will learn and apply species terminology and recognize common breeds of the program animals.
Units of Study	1. Animal Handling and Caretaking Skills 2. Biosecurity

Unit 1	Animal Handling and Caretaking Skills
Essential Questions	1. How do I work with and around animals safely? 2. What equipment, tools and devices are appropriate to restrain different species? 3. How do you adjust husbandry techniques to care for different species of animals?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AS.02.01.04.b. Interpret domestic livestock and companion animal behaviors and outline safety procedures for working with those species. AS.02.02.01.b. Utilize tools, technology and equipment to perform animal husbandry and welfare tasks. AS.06.01.03.c. Apply knowledge of classification terms to communicate with others about animal systems in an effective and accurate manner.
Common Core State Standards	SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. W.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Supporting Standards

Connecticut	AS.02.01.02.b. Analyze and document animal welfare procedures used to ensure safety and maintain low stress when

Agriculture, Food, and Natural Resources Standards	moving and restraining animals. AS.02.01.04.c. Handle and work with domestic livestock, horses, and companion animals safely. CRP.01.01.02.b. Assess personal level of responsibility and examine opportunities for improvement.
Common Core State Standards	RST.9-10.9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

Learning Objectives	Activities	CT AFNR, NGSS, CCSS
Discuss the importance of understanding animal behavior and how that impacts handling and restraint.	• Evaluate images of different species of animals in order to identify blind spots and explain flight zones • Analyze videos of human-animal interactions to identify where mistakes were made when working with and around animals • Observe an animal for a given period of time to track their movement, learn body language meanings and categorize behaviors • List and describe important safety measures and precautions when handling animals • Create a terminology journal of applicable terms	AS.02.01.04.b. AS.02.01.02.b. AS.06.01.03.c. RST.9-10.9. W.9-10.4
Select the appropriate equipment, tools and devices when restraining specific species of animals.	• Identify restraint devices and categorize their type of restraint • Demonstrate how to properly use restraint equipment, tools, and devices	AS.02.01.02.b. AS.02.01.04.c.
Differentiate between the different species of program animals and their basic needs.	• Provide basic care to different species of program animals, including, but not limited to cleaning, feeding and other husbandry tasks • Prepare a presentation on a specific species of animal to identify behavioral cues, breeds, terminology, important anatomical features and specific handling techniques • Demonstrate proper handling techniques for all species	AS.02.01.04.c. AS.02.02.01.b. AS.02.01.02.b. SL.9-10.4 RST.9-10.9. CRP.01.01.02.b.

Unit 2	Biosecurity
Essential Questions	1. Why is biosecurity important to safe animal handling? 2. How do zoonotic diseases affect animal handling strategies?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AS.02.01.03.a. Distinguish between animal husbandry practices that promote animal welfare and those that do not. AS.02.01.05.b. Explain the importance of biosecurity in relation to domestic livestock and companion animals. AS.05.01.03.a. Recognize illnesses and disorders based on symptoms and problems caused by disease, parasites, and disorders among companion, lab and/or domestic animals. AS.07.02.02.b. Analyze the health risk of different zoonotic diseases to humans and identify prevention methods. AS.08.02.01.a. Identify and summarize methods for ensuring optimal environmental conditions for animals.
Common Core State Standards	WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	CS.03.01.02.a. Summarize the importance of safety, health and environmental management in the workplace. CS.03.04.01.a. Identify and differentiate the appropriate protective equipment for the safe use and operation of specific tools and equipment (e.g. PPE, etc.).

Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Objectives	Activities	CT AFNR, NGSS, CCSS
Discuss the importance of proper biosecurity when working with and around animals.	• Demonstrate how to properly clean and disinfect animal enclosures. • Select appropriate disinfecting agents for cleaning different items (i.e. feed bowls/troughs and water bottles/buckets versus cage trays, litter boxes and enrichment toys)	AS.02.01.03.a. AS.02.01.05.b. AS.08.02.01.a. AS.02.01.05.b. CS.03.01.02.a. CS.03.04.01.a.
Discuss characteristics of specific zoonotic diseases.	• Differentiate between pathogens that cause diseases • Conduct research into the causes, signs, treatment and prevention of specific zoonotic diseases • Create a zoonotic disease journal	AS.02.01.05.b. AS.05.01.03.a. AS.07.02.02.b. WHST.9-12.9

Vocabulary:

Field of vision	Bacteria	Zoonotic disease
Blind spot	Virus	Anthrax
Monocular vision	Fungus	Brucellosis
Binocular vision	Parasite	Campylobacteriosis
Flight zone	Host	Leptospirosis
Point of balance	Vector	Salmonelosis
Biosecurity	Restraint	Rabies
Cleaning	Physical restraint	Ringworm
Disinfection	Chemical restraint	Sarcoptic mange

Assessments:
Lab activities
Class assignments
Quizzes
Project

Connections to College/Career Readiness:
Objectives of this course align with those in the MxCC VET 100 and 101 courses as well as UCONN ECE Courses: Companion Animal Management and Animal Behavior and Training, that students can take for credit through Ag 3 and Ag 4 Animal Science classes.

Resources/Materials:
Companion animals and livestock housed at LHS
LHS/LPS staff dogs that attend LHS AgSci canine service program
Cleaning tools and supplies (scrub brushes, disinfectants, etc.)
Restraint devices, tools and equipment (harnesses, halters, pig boards, catch poles, muzzles, etc.)

Course Title	Greenhouse Crop Production
Agriculture Pathway	Plant Systems
Length of Course	Half a quarter
Ledyard High School Vision of the Graduate	Demonstrate an ability to work effectively with others, sharing ideas, acknowledging one another's strengths, and collaborating to produce presentations, projects, performances, or events. Demonstrate critical thinking skills to find solutions, support arguments, and overcome challenges in a variety of content areas.
Course Overview	Students will care for greenhouse crops such as Poinsettias and Chrysanthemums. Students will learn about fertilization techniques, pest management skills, and general greenhouse maintenance. Students will have the opportunity to create floriculture products such as corsages, bud vases, etc.
Units of Study	1. Greenhouse Management 2. Floriculture

Unit 1	Greenhouse Management
Essential Questions	1. How do you properly maintain a greenhouse crop? 2. What are the major components of plant care?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	PS.01.03.01.a. Describe the role of N, P, and K in regards to vegetative growth, root development, seed production, and plant stress. PS.03.02.01.b. Inspect propagation material for evidence of pests or disease.
Common Core State Standards	MP.1. Make sense of problems and persevere in solving them. WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	PS.01.03.02.a. Identify the following from a label of a fertilizer container: percentage of N, P, and K, and calculate the actual amount of the nutrient(s) in the container. PS.01.04.04.a. Identify fertilizer sources of essential plant nutrients; explain fertilizer formulations, including organic and inorganic; and describe different methods of fertilizer application.

	PS.01.04.01.a. Identify the essential nutrients for plant growth and development and their major functions (e.g., nitrogen, phosphorus, potassium, etc.). PS.03.03.02.a. Diagram the life cycle of major plant pests and diseases.
Common Core State Standards	WHST.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. MP.4. Model with mathematics.

Learning Objectives	Activities	CT AFNR, NGSS, CCSS
Demonstrate how to properly care for greenhouse crops.	• Apply proper watering techniques to a variety of greenhouse crops. • Identify the proper fertilizer to be used on greenhouse crops. • Create the proper fertilizer mixture for greenhouse crops. • Understand what different nutrients do for the plants, and how under using and overusing them affects plant quality. • Learn about fertilizer label requirements. • Apply mathematics to determine the pounds of NPK present in a bag of Fertilizer. • Understand water and light requirements for different greenhouse crops such as Poinsettias. • Create informational tags to be sold with different greenhouse plants. • Complete greenhouse checklists	PS.01.03.01.a. PS.01.03.02.a. PS.01.04.04.a. PS.01.04.01.a. MP.1. WHST.9-12.9 MP.4.
Identify common greenhouse pests and create a prevention plan.	• Identify common greenhouse pests. • Identify how to prevent the pest infestation and treat the plants. • Create informational fliers on pests found in the greenhouses. • Implement a pest management plan.	PS.03.02.01.b. PS.03.03.02.a. WHST.9-12.9 WHST.9-12.7

Unit 2	Floriculture
Essential Questions	1. How do you make arrangements using Elements of Design? 2. What do you need to effectively work in the floriculture industry?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	PS.04.01.02.b. Create a design utilizing plants in their proper environments. PS.04.02.03.a. Identify and categorize tools used for design (e.g., computer landscape software, drawing tools, florist tools, etc.).
Common Core State Standards	WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	PS.04.02.01.a. Explain conditioning products as they relate to foliage and flower products. PS.04.02.02.a. Research and summarize the principles and elements of design for use in plant systems.

Common Core State Standards	RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Objectives	Activities	CT AFNR, NGSS, CCSS
Design simple arrangements using design elements.	• Identify common plants used in the floriculture industry. • Create an arrangement following a floral evaluation rubric. • Create bows proportionate to an arrangement. • Identify colors on the color wheel. • Differentiate between monochromatic, achromatic, complementary and split complementary.	PS.04.01.02.b. PS.04.02.01.a. PS.04.02.02.a. WHST.9-12.9 RST.9-10.3.
Identify tools used in the floral industry.	• Identify tools commonly used in the industry. • Explain the use of tools used in the industry. • Condition floral materials used in arrangements • Utilize tools in their proper format.	PS.04.02.03.a. WHST.9-12.9 RST.9-10.4

Vocabulary:

Achromatic
Complementary
Fertilizer
Floral knife
Floral snips
Floral tape
Fungus Gnats
Granular
IPM
Mealy Bugs
Nitrogen
Nutrients
Oasis
Oasis container
Phosphorus
Potassium
Pythium Root rot
Ribbon
Scale
Slow release
Soil
Split-complementary
Thrips
Split-complementary
Thrips
Water soluble
White Fly
Wire
Wire cutters

Assessments:
Greenhouse quiz
Unit Test
Poster project
Nutrient flier
Fertilizer Label Project
Greenhouse lab work

Connections to College/Career Readiness:
Objectives of this course align with those in the UConn ECE Floral Art, Advanced Floral Design and Fundamentals of Horticulture courses that students can take for credit through Ag 3 and Ag 4 Plant System classes.

Resources/Materials:
PowerPoints
Text: Soil Science and Management by Edward J. Plaster
Text: The Art of Floral Design, Hunter
Text: Florists' Review Design School
Text: Floriculture: Designing & Merchandising, Griner
https://www.floraldesigninstitute.com/

Course Title	Natural Resources: Field and Forest
Agriculture Pathway	Natural Resource Systems
Length of Course	Half a quarter
Ledyard High School Vision of the Graduate	Demonstrate an ability to solve problems of varying complexity across content areas. Demonstrate critical thinking skills to find solutions, support arguments, and overcome challenges in a variety of content areas.
Course Overview	This unit is an introduction to the foundational concepts and skills used in working with and managing Natural Resource Systems.The school campus and forest land serve as the laboratory for hands-on learning opportunities. Emphasis is given to developing knowledge and skills needed when working with natural resources in a career or private life.
Units of Study	1. Ecosystems and Ecology 2. Natural Resource Tools and Skills

Unit 1	Ecosystems and Ecology
Essential Questions	1. What are the different components of ecosystems? 1. How do organisms interact with each other and with non-living components in ecosystems?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	ESS.05.02.04.c. Evaluate a habitat to determine its ecological quality and if it is threatened. NRS.01.01.01.a. Summarize and classify the different kinds of natural resources using common classification schemes (e.g., living versus nonliving, renewable versus nonrenewable, native versus introduced, etc.). NRS.01.01.01.b. Assess the characteristics of a natural resource to determine its classification. NRS.01.01.02.a. Summarize the components that comprise all ecosystems. NRS.01.01.03.c. Evaluate biodiversity in ecosystems and devise strategies to enhance the function of an ecosystem and the availability of natural resources by increasing the level of biodiversity. NRS.01.06.02.a. Research and summarize examples of invasive species. NRS.01.06.02.c. Evaluate the presence and impact of invasive species on natural resources in a given area and devise a plan to prevent, control or eliminate invasive species from that habitat. NRS.04.01.04.a. Identify and categorize characteristics of a healthy wildlife habitat. NRS.04.03.02.a. Identify and classify invasive species common to a particular region. NRS.01.06.02.c. Evaluate the presence and impact of invasive species on natural resources in a given area and devise a plan to prevent, control or eliminate invasive species from that habitat.
Next Generation Science Standards	HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

Common Core State Standards	RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. WHST.9-10.2 - Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. WHST.9-10.7 - Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. MP 4 Model with mathematics

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	NRS.01.02.07.b. Apply identification techniques to determine the types of non-living resources in an area. NRS.01.05.01.a. Research and describe the stages of ecological succession.
Next Generation Science Standards	HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
Common Core State Standards	WHST.9-10.8 - Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. WHST.9-10.9 - Draw evidence from informational texts to support analysis, reflection, and research. MP 2 Reason abstractly and quantitatively. MP 4 Model with mathematics.

Learning Objectives	Activities	CT AFNR, NGSS, CCSS
Make and record field observations.	• Read and discuss an article on keeping a scientific journal: such as the one at **How to keep a field journal.** • Record observations on a field note for 20 minutes while sitting in an assigned sit-spot, then discuss observations, questions and challenges. • Return to a designated sit-spot daily for a period of time and keep a journal of field observations, discussing findings, using in-class resources to research a chosen object of interest: e.g. an organism.	RST.9-10.4 SL.9-10.4 WHST.9-10.2 WHST.9-10.7
Classify natural resources using common classification schemes.	• Review key terms such as: natural resource, renewable, non-renewable, biotic, a-biotic, checking for prior knowledge and providing notes or a handout summarizing the terms • View the video at ESS3A - Natural Resources and take notes of the ways in which natural resources are categorized. • Study a map of world mineral resources such as Mineral Map of the World and discuss the distribution of the various minerals. Select one mineral, research it and present findings on the importance of this mineral in modern life and the impact of its relative scarcity or abundance.. • Walk the campus, writing down natural resources seen. Upon return to the classroom categorize them as biotic or abiotic, renewable or nonrenewable.	NRS.01.01.01.a NRS.01.01.01.b. NRS.01.01.02.a. NRS.01.02.07.b. RST.9-10.3 RST.9-10.4 SL.9-10.4
Explain the importance of biodiversity in healthy ecosystems.	• Watch videos like Autotrophs and Heterotrophs, Food Webs and Energy Pyramids: Bedrocks of Biodiversity and Ecological Relationships explaining concepts of food webs and biodiversity. Use a worksheet such as AMOEBA SISTERS: VIDEO RECAP FOOD WEBS, ENERGY PYRAMIDS, AND AN INTRODUCTION TO BIODIVERSITY to review learning. • Observe and identify organisms and key abiotic components of the terrestrial ecosystem in the school woodland. Create an ecosystem diagram based on observations. • Play a carrying capacity simulation game such as Animal Herd Role Play. Discuss how factors other than food may influence carrying capacity. • Construct a series of slides showing the key abiotic attributes	NRS.01.01.01.b. NRS.01.01.02.a. NRS.01.01.03.c. NRS.04.01.04.a. NRS.01.06.02.a. NRS.01.06.02.c. RST.9-10.4 HS-LS2-6.

	of a Connecticut ecosystem (swamp, meadow, woodland, etc…) and representative species in either food web or trophic pyramid.	
Evaluate the health of an ecosystem	• Explore and calculate various measures of biodiversity through an activity such as Biodiversity Studies in Garagosa, calculating different measures of biodiversity using the data provided in that lesson. • Conduct a hula hoop sample (Hula Hoop Sampling or Hula Hoop Biodiversity) of a well maintained lawn area on campus and calculate measures of biodiversity. Compare results to those obtained when sampling in a less-well-tended area. • Using resources like Invasive Plant List | Connecticut Invasive Plant Working Group locate invasive species on campus. Research one of the identified species and report verbally on the way it impacts the ecosystem and effective control techniques. This lesson may be extended beyond campus using more general resources such as those at Invasive Species. • Watch a presentation such as A Garden for Wildlife: Natural Landscaping for a Better … and use learning to evaluate a landscape for its suitability as a wildlife habitat. Suggest changes to increase the biodiversity of that landscape. • Research ways to control invasive species found on campus or the adjacent woodland. Document findings and present them to the appropriate agency (LPS facilities, Ledyard Parks and Rec, etc…) obtain permission and conduct control measures. • Identify, harvest and prepare edible invasive species (Eat The Invaders) such as garlic mustard and autumn berry in which the act of harvesting can exercise some control. Prepare an informative handout encouraging people to do the same.	ESS.05.02.04.c. NRS.01.01.03.c. NRS.01.06.02.a. NRS.01.06.02.c. NRS.04.01.04.a NRS.04.03.02.a. HS-LS2-1. HS-LS2-2. HS-LS2-6. HS-LS2-7. HS-LS4-5. RST.9-10.3. RST.9-10.4. SL.9-10.4 HS-ETS1-2. MP 2 MP 4

Unit 2	Natural Resource Tools and Skills
Essential Questions	1. How do I identify plant and animal species? 2. How do I locate and describe the location of things on the landscape? 3. How do I evaluate timber resources?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	NRS.01.02.02.b. Apply identification techniques to determine the species of a tree or woody plant. NRS.03.03.01.b. Apply cartographic skills and tools and technologies (e.g., land surveys, geographic coordinate systems, etc.) to locate natural resources NRS.03.03.02.a. Identify the following components of a topographical map: contour lines, wetlands, buildings, compass, and scale. NRS.03.03.03.a. Describe basic applications of global positioning systems in natural resources. NRS.05.05.01.b. Demonstrate the proper use for the following tools in natural resources: GPS unit, diameter tape, telemetry unit, seines, aquatic net, water meter, animal tag or band, Biltmore stick, Secchi disk, analog refractometer, and hydrometer. NRS.05.05.02.c. Demonstrate the safe use of tools, materials and equipment for use in natural resources
Common Core State Standards	RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. WHST.9-10.7 - Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	NRS.01.01.01.b. Assess the characteristics of a natural resource to determine its classification. NRS.01.02.01.c. Create dichotomous keys to reflect trees, fish and wildlife found in Connecticut NRS.01.02.03.b. Apply identification techniques to determine the species of an herbaceous plant. NRS.01.02.04.b. Apply identification techniques to determine the species of wildlife or insect

	NRS.03.03.03.b. Analyze an area's resources using GIS technologies.
Common Core State Standards	SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. WHST.9-10.2 - Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

Objectives	Activities	CT AFNR, NGSS, CCSS
Understand and use appropriate terminology used to identify organisms.	• Using resources such as LEAF TERMINOLOGY or the "How to use this guide" section of field guides in the Ag-Science library, collect twigs and leaves or buds of different position, complexity and form, labeling them with those characteristics. This may be done using physical samples or as a digital collection using photographs or sketches taken in the field. • Choose one organism that stands out from observations in the field or at a sit-spot. Make and record detailed observations about the morphology and other observable characteristics of the organism. Use these, field guides and online resources to identify the organism. Report on the terms that were used to identify the organism and their meanings. • Use applications such as BirdNET Sound ID to identify birds in the field by their song. If possible, confirm the identification with visual observation of the bird. Research text resources about bird identification and compare the phonetic representation with what was heard. • Collect samples and photographs of fungi, make spore prints and identify the fungi using substrate, morphology and characteristics of the spores (color plus shape and form as observed under a microscope). • Make fungal spore print art using caps of fungi collected in the field and appropriately colored card stock and spray sealant.	NRS.01.01.01.b. NRS.01.02.02.b. NRS.01.02.02.b. RST.9-10.4 WHST.9-10.2 WHST.9-10.7

Use dichotomous keys.	• Use a dichotomous key such as Monster Dichotomous Key CLASS COPY to develop understanding of how to use dichotomous keys. • Using pictures of various familiar foods use the observable characteristics of the food (color, texture, taste, etc…) to develop a dichotomous key. Test the usefulness of the completed key by having other students use it to identify the pictured foods. • Employ a dichotomous key from the Agri-Science library or those at Summer and Winter Keys or What Tree Is That? Tree Identification Guide at arborday.org to identify trees on campus.	NRS.01.02.02.b. NRS.01.02.01.c. NRS.01.02.03.b. NRS.01.02.04.b. RST.9-10.3. RST.9-10.4.
Employ cartographic skills.	• Study topographic maps of the area around campus (How do I find, download, or order topographic maps? | U.S. Geological Survey) identify key symbols and map characteristics and their meanings. Identify and visit points of interest using the map coordinates and GPS. • Make cardboard or foam core models of terrain based on a topographic map. • Form an interesting landscape profile using modeling clay and make a topographic map of that profile by cutting and tracing sections as described here Make a topographic map! | NASA Space Place. • Conduct Compass-Skill-Activities to learn compass concepts and navigation. • Conduct a scavenger hunt in which the clues to locations are latitude and longitude coordinates. Use GPS units (or phones with GPS apps) to navigate to each of the locations. • Calculate student pace factor. (Distance Measurement) • Follow a set of directions in which waypoints are based on compass bearing and distance. Follow the directions using only compass and pacing. Evaluate accuracy by the final distance from the target point. • Use GPS to locate geocaches on the Burton Property trails.	NRS.03.03.01.b. NRS.03.03.02.a. NRS.03.03.03.a. NRS.0.05.01.b. RST.9-10.3. RST.9-10.4.
Evaluate timber resources.	• Use a tree caliper and diameter tape to measure Diameter at Breast Height (dbh) How to Measure a Tree | Portland.gov , Measuring Standing Trees | Ohioline • Use a Biltmore stick to measure dbh and estimate timber	NRS.0.05.01.b. NRS.0.05.02.c. RST.9-10.3. RST.9-10.4.

	yield of standing trees. HOW TO USE A BILTMORE STICK, Measuring Tree Volume with a Biltmore Stick • Estimate the value of living trees. National Tree Benefit Calculator, i-Tree	

Vocabulary:

Abiotic	Board foot	Energy pyramid	Noxious	Quorum sensing
Alternate	Carnivore	Entire	Omnivore	Renewable
Apical bud	Carrying capacity	Food web	Opposite	Serrated
Autotroph	Consumer	Heterotroph	Palmate	Sinus
Biltmore stick	Decomposer	Invasive	Pinnate	Tree caliper
Biodiversity	Diameter at breast height	Lobe	Population density	Trophic cascade
Biotic	Diameter tape	Natural resource	Producer	Trophic levels

Assessments:
Dichotomous key assessment
Species ID formative assessments in the field
Unit Quiz

Connections to College/Career Readiness:
Objectives in this unit prepare students for further studies in Natural Resources in Ag 2, 3 or 4 electives or to explore natural resource careers as indicated in Natural Resources Systems | AgExplorer

Resources/Materials:
Campus grounds and the Burton Property (adjoining woodland)
USDA Plants Database website
Website: Connecticut Invasive Plant Working Group
Text: A Field Guide to Eastern Forests. Kricher and Morrison. Houghton Mifflin, 1998.
Text: A Field Guide to Trees and Shrubs. Petrides. Houghton Mifflin, 1972.
Text: A Field Guide to Mushrooms. McKnight and McKnight. Houghton Mifflin, 1987.
Text: Know Your Trees. Cope and Winch. Cornell Cooperative Extension, 1998.
Equipment for laying out sample areas: hula hoops, string, markers, tape measures
Equipment for measuring standing trees: Biltmore sticks, tree calipers, diameter tapes

GPS Units, compasses, tape measures, USGS topographic maps of Uncasville and Old Mystic Quadrangles

Course Title	Shop Safety
Agriculture Pathway	Power, Structural and Technical Systems
Length of Course	Half a quarter
Ledyard High School Vision of the Graduate	Demonstrate an ability to solve problems of varying complexity across content areas. Demonstrate critical thinking skills to find solutions, support arguments, and overcome challenges in a variety of content areas.
Course Overview	Shop Safety focuses on the safety, proper use and maintenance of hand and power equipment used in an agriculture mechanics wood shop. Safety will be a recurring subject covering proper attire, behavior and practice in a shop setting. Students will use a 3-view blueprint plan and various power and hand-held tools to construct a woodworking project.
Units of Study	1. Foundational concepts of timber harvesting 2. Tool use and safety 3. Following project plans 4. Preparing and finishing a woodworking project

Unit 1	Foundational Concepts of Timber Harvesting
Essential Questions	1. What are the tools and techniques used to select and harvest timber? 2. How does a log become dimensional lumber?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	NRS.01.02.02.b. Apply identification techniques to determine the species of a tree or woody plant. NRS.03.01.01.a. Summarize forest harvesting methods. NRS.0.05.02.b. Describe the proper safe use or function of tools, materials and equipment for use in natural resources. PST.04.03.03.a. Compare and contrast the characteristics of wood and/or metal products used in AFNR structures.
Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	CRP.08.01.01.b. Apply steps for critical thinking to a variety of workplace and community situations PST.01.02.02.a. Identify and explain the uses of the following woodworking tools used in agricultural construction: circular saw, drill press, jig/sabre saw, reciprocating saw, table saw, orbital sander, belt sander, router, portable drill, and miter saw. PST.04.03.01.a. Examine the criteria in selecting materials for constructing, maintaining, and/or repairing AFNR structures.
Common Core State Standards	MP 4 Model with mathematics MP 5 Use appropriate tools strategically

Learning Objectives	Activities	CT AFNR, NGSS, CCSS
Demonstrate proper tree measurement and selection techniques	● Discussion on selection of harvestable timber ● Demonstrate timber cruising techniques ● Identify traits and characteristics of hardwood vs. softwood trees ● Identify forestry measurements such as Board Feet, Cord, Chain, DBH, and Merchantable Height	NRS.0.05.02.b. NRS.01.02.02.b. CRP.08.01.01.b. MP 4 MP 5
Identify Tree harvesting techniques	● Demonstrate timber harvesting equipment through digital resources ● Observe different chainsaw cuts when felling and limbing trees ● Provide demonstration on safety equipment used in timber harvesting	NRS.03.01.01.a. NRS.0.05.02.b. CRP.08.01.01.b.
Observe Lumber processing techniques	● Provide a digital demonstration on timber processing equipment and techniques ● Provide a video journey through a sawmill ● Compare and contrast saw mill cutting techniques	NRS.03.01.01.a. NRS.0.05.02.b. PST.04.03.03.a. PST.01.02.02.a
Compare and contrast different cuts of wood	● Demonstrate the different sawmill cuts of lumber such as plane, quarter and rift ● Identify characteristics of sawmill cuts including strength, value, and grain pattern ● Discuss what types of lumber should be used for specific projects	NRS.0.05.02.b. NRS.01.02.02.b. PST.04.03.03.a. PST.01.02.02.a PST.04.03.01.a. RST.9-10.4

Unit 2	Tool use and Safety
Essential Questions	1. What are the characteristics of a safe shop? 2. How do you measure, cut and fasten wood safely? 3. How do I determine which tool to use and for what purpose?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CS.06.02.01.a. Use proper safety practices/personal protective equipment. CS.08.01.01.c. Use tools and equipment appropriately to complete a specific task. PST.01.02.02.a. Identify and explain the uses of the following woodworking tools used in agricultural construction: circular saw, drill press, jig/sabre saw, reciprocating saw, table saw, orbital sander, belt sander, router, portable drill, and miter saw. PST.02.02.02.b. Apply safety principles and applicable regulations to operate equipment, machinery and power units used in AFNR power, structural and technical systems. PST.04.03.01.a. Examine the criteria in selecting materials for constructing, maintaining, and/or repairing AFNR structures. PST.04.03.03.a. Compare and contrast the characteristics of wood and/or metal products used in AFNR structures.
Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	CRP.08.01.01.b. Apply steps for critical thinking to a variety of workplace and community situations PST.01.02.03.b. Select, maintain and demonstrate the proper use of tools, machines and equipment used in different AFNR related mechanical systems. PST.02.01.01.a. Maintain the cleanliness and appearance of equipment, machinery and power units used in AFNR power, structural and technicalsystems to assure proper functionality.

Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. MP 4 Model with mathematics MP 5 Use appropriate tools strategically

Objectives	Activities	CT AFNR, NGSS, CCSS
Demonstrate shop safety procedures, techniques and preparation	• Review and discuss proper shop attire and personal protective equipment • Create scenarios to demonstrate unsafe situations in the workplace and discuss how to inform and correct them. • Demonstrate and appropriately use the knowledge of personal safety practices such as safe attire and personal protective equipment • Recognize and demonstrate proper storage and clean-up techniques in a wood shop • Operate a fire extinguisher using P.A.S.S. • Identify safety hazards in the shop and provide suggestions on how to fix or improve the situation	CS.06.02.01.a. PST.02.01.01.a. RST.9-10.4
Select and safely use appropriate hand tools and procedures for a given task	• Identify and describe the various tools used in a woodshop and the purpose for each • Demonstrate the ability to safely use hand tools such as the hammer, saw, files, and drills • Use each hand tool for a specific purpose • Properly identify defects in hand tools • Properly store and organize hand tools	CS.08.01.01.c. CRP.08.01.01.b. PST.01.02.03.b. PST.02.02.02.b. PST.04.03.01.a.
Demonstrate proper measurement and marking techniques	• Use measurement devices to measure and calculate length, width, thickness, and square feet • Measure dimensional lumber to the 1/16 of an inch • Measure, mark and prepare dimensional lumber for cutting • Demonstrate an understanding of kerf when preparing a board for cutting	CS.08.01.01.c. CRP.08.01.01.b. RST.9-10.4

Analyze wood stock based on their properties and condition	• Identify characteristics of wood such as grain direction, hardness, size and condition • Identify features of wood that may be unsafe or inappropriate to cut • Demonstrate an understanding between hardwood and softwood lumber • Differentiate and demonstrate crosscuts, rip cuts and miter cuts	CRP.08.01.01.b. PST.01.02.02.a. PST.04.03.01.a. PST.04.03.03.a.
Safely use power tools for a woodworking project	• Perform a pre-operation safety check on a power tool; identify and correct any safety concerns. • Discuss the safety, procedures and use for each power tool used in a woodshop such as the table saw, miter saw, drill press, jig saw and power drill. • Pass a guided practical on safety and operation of woodshop tools • Demonstrate the ability to safely operate the woodshop power tools independently • Provide safety scenarios for students to analyze and respond regarding safe and proper power tool use	CS.06.02.01.a. CS.08.01.01.c. PST.01.02.02.a. PST.01.02.03.b. PST.02.02.02.b.

Unit 3	Following Project Plans
Essential Questions	1. How does one read and interpret a 3-view blueprint? 2. How does one prepare and construct a project using a 3-view blueprint?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CS.06.02.01.a. Use proper safety practices/personal protective equipment. CS.08.01.01.c. Use tools and equipment appropriately to complete a specific task. PST.01.02.02.a. Identify and explain the uses of the following woodworking tools used in agricultural construction: circular saw, drill press, jig/sabre saw, reciprocating saw, table saw, orbital sander, belt sander, router, portable drill, and miter saw. PST.01.02.03.b. Select, maintain and demonstrate the proper use of tools, machines and equipment used in different AFNR related mechanical systems. PST.04.01.01.a. Interpret and explain the meaning of symbols used in sketches of agricultural structures
Common Core State Standards	RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. CRP.08.01.01.b. Apply steps for critical thinking to a variety of workplace and community situations MP 5 Use appropriate tools strategically

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources	CRP.08.01.01.b. Apply steps for critical thinking to a variety of workplace and community situations PST.02.02.02.b. Apply safety principles and applicable regulations to operate equipment, machinery and power units used in AFNR power, structural and technical systems.

Standards	PST.04.03.01.a. Examine the criteria in selecting materials for constructing, maintaining, and/or repairing AFNR structures.
Common Core State Standards	MP.1. Make sense of problems and persevere in solving them. MP. 4. Model with mathematics RST.11-12.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics

Objectives	Activities	CT AFNR, NGSS, CCSS
Interpret a 3-view blueprint plan for a small woodworking project	• Read and discuss a 3-view project plan for a toolbox or other small woodworking project • Use a project plan to determine the proper materials for a given project • Follow a materials list to prepare stock • Review and demonstrate proper techniques for cutting and fastening stock • Read a project plant to determine the size and location of fasteners	CRP.08.01.01.b. PST.01.02.02.a. PST.04.01.01.a. CRP.08.01.01.b. RST.9-10.3 MP.1
Follow a 3-view blueprint plan to measure, cut, adjust and fasten a woodworking project	• Identify and select appropriate tools or each phase of a woodworking project • Follow the instructions on a 3-view blueprint plan to measure measure and cut wood • Follow a plan to dry-fit assemble a woodworking project • Repair or make adjustments to project • Select appropriate fasteners and fastening tools to assemble a woodworking project	CS.06.02.01.a. CS.08.01.01.c. CRP.08.01.01.b. PST.01.02.03.b. PST.02.02.02.b. PST.04.03.01.a. CRP.08.01.01.b. RST.11-12.4. MP.1 MP 4 MP 5

Unit 4	Preparing and finishing a woodworking project
Essential Questions	1. How do you prepare wood for a finish coat? 2. What is the appropriate finish coat to use on wood? 3. What are the proper steps when applying a wood finish?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CS.06.02.01.a. Use proper safety practices/personal protective equipment. CS.08.01.01.c. Use tools and equipment appropriately to complete a specific task. PST.01.02.03.b. Select, maintain and demonstrate the proper use of tools, machines and equipment used in different AFNR related mechanical systems. PST.04.03.01.a. Examine the criteria in selecting materials for constructing, maintaining, and/or repairing AFNR structures. PST.04.03.03.a. Compare and contrast the characteristics of wood and/or metal products used in AFNR structures.
Common Core State Standards	RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	CRP.08.01.01.b. Apply steps for critical thinking to a variety of workplace and community situations PST.02.01.01.a. Maintain the cleanliness and appearance of equipment, machinery and power units used in AFNR power, structural and technicalsystems to assure proper functionality. PST.02.02.02.b. Apply safety principles and applicable regulations to operate equipment, machinery and power units used in

	AFNR power, structural and technical systems.
Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Objectives	Activities	CT AFNR, NGSS, CCSS
Investigate multiple solutions to repair a woodworking project	● Repair small cracks or dents in wood using adhesives and wood filler ● Identify and repair any gaps or fractures that may compromise the structural integrity of the woodworking project ● Repair or replace wood where appropriate	CS.06.02.01.a. CS.08.01.01.c. CRP.08.01.01.b. PST.01.02.03.b. PST.04.03.01.a. PST.04.03.03.a.
Prepare the surface of wood for a finish coat	● Use hand tools and power sanders to repair wood surfaces ● Use various sandpaper grits to smooth dents, scratches and marks on wood surfaces ● Use various grits of sandpaper to smooth wood in preparation of a finish coat ● Clean and dry surfaces in preparation for a finish coat	CS.06.02.01.a. CS.08.01.01.c. PST.01.02.03.b. PST.02.01.01.a. PST.02.02.02.b. PST.04.03.01.a.
Choose and apply a finish coat to wood surfaces	● Discuss the various types of finish coats for wood surfaces such as stain, clear coats, paints, etc. ● Review the application for each wood finish including mixing, storing, brushes, application procedures and specific instructions ● Discuss VOC's (Volatile Organic Compounds) and the dangers they pose when inhaled ● Design and implement a plan to reduce or eliminate fumes while applying finishes to wood ● Identify and implement safety equipment used while applying food finishes ● Apply finishes according to instuctions	CS.06.02.01.a. CS.08.01.01.c. PST.01.02.03.b. PST.02.02.02.b. RST.9-10.3 RST.9-10.4

Vocabulary:

Claw Hammer	Table Saw	Miter Cut
Nail Set	Miter Saw	Hand Saw
Tri Square	Reciprocating Saw	Tensile Strength
Speed Square	Jigsaw	Shear Strength
Combination Square	Drill Press	Band Saw
Framing Square	Forstner Drill Bit	
Speed/Quick Clamp	Countersink Drill Bit	
Bar Clamp	Tape Measure	
Spring Clamp	Cross Cut	
Cordless Drill/Driver	Rip Cut	

Assessments:

Woodworking Construction Assessment
Shop Safety Assessment
Shop Safety Final (Google Form)
Shop Safety Final - Written

Connections to College/Career Readiness:

Resources/Materials:

Purdue University Power Tool Safety Guides:
https://www.purdue.edu/woodresearch/aboutus/safety/
Woodworking Manufacturing Technologies Department (WMT) Cerritos College Norwalk, California:
https://www.cerritos.edu/woodworking/_includes/docs/Safety_Manual_2017a.pdf
North Mason Woodworking Safety Units:
https://www.nmsd.wednet.edu/userfiles/99/Classes/2054//userfiles/99/my%20files/woodworking%20safety%20unit%20correct%20(2).pdf?id=8880

Approved by Instructional Council on May 31, 2023

Agri-Science II
Pathway Units

Students will be surveyed to determine which elective units will be offered each spring based on student interest and career exploration.

Pathway Units- Semester 2

Animal Nutrition & Reproduction
Farm to Fork
Laboratory Animal Science
Recirculating Systems Aquaculture
Aquaponics
Horticulture Business Practices
Sustainable Horticulture
Biotechnology
Introduction to Landscaping
Natural Resource Products
Ag Maintenance: Electrical & Plumbing
Metal Fabrication
Leadership

Approved by Instructional Council on May 31, 2023

Course Title	Animal Nutrition & Reproduction
Agriculture Pathway	Animal Systems
Length of Course	One Quarter
Ledyard High School Vision of the Graduate	Demonstrate an ability to solve problems of varying complexity across a variety of content areas.
Course Overview	Animal Nutrition is essential for the health and well-being of animals. Students will become knowledgeable about the nutrients, animal feeds and supplements, digestive tracts, feeding recommendations and storage of feed for exotic animals, reptiles, companion animals and livestock. Students will feed the school animals, observe their daily intake of feed and water and check their health. Students will balance rations using Pearson Square, complete a feed cost comparison, a maintenance energy requirement, calculate dry matter, and interpret feed labels. They will apply the skills and knowledge of this course to maintain proper animal health for exotic animals, reptiles, companion animals and livestock. Students will learn fundamental knowledge of the anatomy and physiology of mammalian, avian, reptilian and amphibian reproductive systems. Topics addressed include comparison of healthy and abnormal reproductive performance and current trends in reproductive management toward herd/flock improvement and profit.
Units of Study	1. Digestive Systems 2. Nutritional Requirements 3. Animal Breeding 4. Reproductive Systems

Unit 1	Digestive Systems
Essential Questions	1. How does a ruminant, nonruminant, pseudo ruminant and avian digest their food? 2. How does an animal absorb and metabolize their nutrients?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AS.05.01.03.a. Recognize illnesses and disorders based on symptoms and problems caused by disease, parasites, and disorders among companion, lab and/or domestic animals.
Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AS.01.01.01.a. Identify and summarize the origin, significance, distribution and domestication of different animal species.
Common Core State Standards	SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Learning Objectives	Activities	CT AFNR, NGSS, CCSS
Describe and evaluate the ruminant, nonruminant and cecal fermenter digestive tracts	• Describe and differentiate between the function of the ruminant, nonruminant, pseudo ruminant and avian digestive system • Create an animal digestive system which includes: digestive system parts, how food passes through the digestive tract, how food breaks down with the acids and enzymes based on the types of feed the animal consumes	AS.05.01.03.a AS.01.01.01.a. RST.9-10.4 WHST.9-10.4 SL.9-10.4
Recognize the connection between appropriate management and healthy animals	• Analyze photos of animals and categorize them as healthy or unhealthy	AS.05.01.03.a SL.9-10.4
Identify and describe the six basic food nutrients including the composition and their function	• Describe the ways animals utilize nutrients • Compare and contrast between a roughage and a concentrate	AS.05.01.03.a RST.9-10.4 WHST.9-10.4 SL.9-10.4

Unit 2	Nutritional Requirements
Essential Questions	1. How many calories does a cat and a dog need each day based upon their nutritional requirements? 2. How and why do we balance rations for livestock?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AS.02.01.04.c. Handle and work with domestic livestock, horses, and companion animals safely. AS.03.01.01.a. Identify and summarize essential nutrients required for animal health and analyze each nutrient's role in growth and performance. AS.03.01.02.a. Differentiate between nutritional needs of animal species. AS.03.02.01.a. Compare and contrast common types of feedstuffs and the roles they play in the diets of animals. AS.03.02.02.a. Examine the importance of a balanced ration for animals based on the animal's growth stage (e.g., maintenance, newborn, gestation, lactation, etc.). AS.03.03.02.a. Examine and summarize the meaning of various components of feed labels and feeding directions. AS.08.02.01.a. Identify and summarize methods for ensuring optimal environmental conditions for animals. CS.03.04.01.a. Identify and differentiate the appropriate protective equipment for the safe use and operation of specific tools and equipment (e.g. PPE, etc.).
Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience MP. 4 Model with mathematics MP. 6 Attend to precision

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AS.02.01.01.a. Explain the implications of animal welfare and animal rights for animal systems. AS.03.02.03.a. Examine the purpose, impact and mode of action of feed additives and growth promotants in animal production AS.03.03.03.a. Examine the use of technology to provide animal nutrition. AS.05.01.01.a. Differentiate between the types of facilities needed to house and produce animal species safely and efficiently.

Common Core State Standards	SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Objectives	Activities	CT AFNR, NGSS, CCSS
Calculate feed costs and nutritional requirements	• Read a given scenario and compare and contrast feed costs • Read a given scenario and determine dry matter and maintenance energy requirements for animals	AS.03.01.02.a. RST.9-10.4 WHST.9-10.4 MP. 4 MP. 6 SL.9-10.4
Interpret feed labels & identify feeds	• Recommend an animal feed based on feed label interpretation • Evaluate a feed label for its effectiveness and use • Determine if the feed is a concentrate, roughage or a supplement based on a label • Identify and classify a variety of companion and livestock feeds	AS.03.01.01.a. AS.03.01.02.a AS.03.02.01.a. AS.03.03.02.a. AS.03.02.03.a. RST.9-10.4 WHST.9-10.4 SL.9-10.4
Formulate feed rations	• Balance a ration using the Pearson Square for growth, maintenance, production, reproduction, fattening and work • Explain the importance of a balanced ration for animals	AS.03.02.02.a. AS.03.03.03.a. RST.9-10.4 WHST.9-10.4 MP. 4 MP. 6
Work safely in the animal lab	• Feed animals according to their nutritional requirements • Monitor and replenish water supply as directed using the appropriate water container • Demonstrate proper hygiene and sanitation • Properly store animal feed in specified bins	AS.02.01.04.c. AS.03.01.02.a. AS.08.02.01.a. CS.03.04.01.a. AS.02.01.01.a. AS.05.01.01.a. SL.9-10.4

Unit 3	Animal Breeding
Essential Questions	1. Why do we study animal reproduction? 2. How do you determine which animals to use for breeding? 3. How have reproductive technologies impacted the livestock and companion animal industries?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AS.04.01.02.a. Compare and contrast how age, size, life cycle, maturity level and health status affect the reproductive efficiency of male and female animals. AS.04.02.04.a. Identify and summarize different needs of breeding animals based on their growth stages (e.g., newborn, parturition, gestation, gestation lengths, etc.). AS.04.03.01.a. Identify and categorize natural and artificial breeding methods (e.g., natural breeding, artificial insemination, estrous synchronization, flushing, cloning, etc.). AS.06.02.02.c. Apply the processes of meiosis and mitosis to solve animal growth, development, health and reproductive problems.
Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AS.04.01.02.c. Evaluate and select animals for reproductive readiness. AS.04.01.03.a. Summarize the importance of efficient and economic reproduction in animals. AS.04.02.01.b. Compare and contrast the use of genetically superior animals in the production of animals and animal products. AS.04.02.03.a. Identify and summarize genetic defects that affect animal performance. AS.04.02.04.b. Analyze the care needs for breeding stock in each stage of growth. AS.04.03.03.a. Identify and summarize the advantages and disadvantages of major reproductive management practices, including estrous synchronization, superovulation, flushing and embryo transfer (e.g., cost, labor, equipment, etc.).

	AS.08.02.02.b. Implement and evaluate the effectiveness of methods to ensure optimal environmental conditions for animals.
Common Core State Standards	WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Objectives	Activities	CT AFNR, NGSS, CCSS
Discuss the importance of genetics when making breeding decisions.	• Determine desired inheritable traits and create a breeding plan for school animals • Evaluate pedigrees and expected progeny differences (EPD)s to determine which animals to mate	AS.04.01.02.a. AS.04.01.02.c. AS.04.01.03.a. AS.04.02.01.b. AS.04.02.03.a. RST.9-10.4
Explain gametogenesis.	• Compare and contrast mitosis and meiosis • Compare and contrast spermatogenesis and oogenesis • Create a meiosis flip book or model mitosis and meiosis using the Carolina Biological Lab	AS.04.02.03.a. AS.06.02.02.c. RST.9-10.4 WHST.9-10.4
Discuss the stages of the Estrous Cycle.	• Observe animals for breeding readiness behaviors • Create a chart to demonstrate hormonal influence on ovulation and pregnancy	AS.04.03.03.a. WHST.9-10.4
Determine how reproductive technologies are utilized in the animal industry.	• Investigate reproductive technologies: artificial insemination, cloning, embryo transfer, etc. • Observe (live or virtually) an artificial insemination procedure • Review Herd Sire Directories and determine best sires for breeding	AS.04.03.01.a. AS.04.01.02.c. AS.04.03.03.a.
Discuss the stages of embryonic development.	• Compare and contrast embryonic development of species that incubate versus gestate • Create an embryonic development timeline	AS.04.02.04.b. WHST.9-10.4
Demonstrate proper care of animals during all stages of reproduction (i.e. breeding stock, pregnant dams, growing offspring, neonates).	• Determine nutritional changes for stage of life and demonstrate proper feeding • Setup housing requirements for parturition of a variety of program animals	AS.04.02.04.a. AS.04.02.04.b. AS.08.02.02.b.

	• Demonstrate proper sanitation of animal housing and enclosures during breeding, gestation, incubation, parturition and offspring rearing	

Unit 4	Reproductive Systems
Essential Questions	1. How does reproductive anatomy influence the physiology of fertilization? 2. What physical adaptations have specific species of animals developed to improve breeding success?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AS.04.01.01.b. Analyze the functions of major organs in the male and female reproductive systems. AS.06.03.01.b. Compare and contrast desirable anatomical and physiological characteristics of animals within and between species.
Common Core State Standards	SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AS.04.01.02.c. Evaluate and select animals for reproductive readiness.
Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

Objectives	Activities	CT AFNR, NGSS, CCSS
Investigate the functions of male and female reproductive organs.	• Relate optimal reproductive function to physical characteristics by conducting a breeding soundness examination on a program animal • Dissect (live or virtual) pregnant female reproductive tracts (Cow, Sow, Rats) • Observe a castration and/or ovariectomy (live or virtual)	AS.04.01.01.b. AS.06.03.01.b. AS.04.01.02.c.
Differentiate between species anatomical differences with regards to reproductive anatomy.	• Investigate a specific animal's reproductive tract and anatomy and prepare a presentation to teach classmates about unique and species specific reproductive characteristics	AS.04.01.01.b. AS.06.03.01.b. SL.9-10.4 RST.9-10.4

Vocabulary:

Anestrus	Meiosis	Abomasum	Pseudo ruminant
Diestrue	Metestrus	Avian	Ration
Diploid	Mitosis	Colostrum	Regurgitate
Estrous	Oogenesis	Crude Fiber	Reticulum
Estrus	Ovulation	Crude Protein	Roughage
Expected Progeny Difference/Value	Pedigree	Cud	Rumen
Gametogenesis	Phenotype	Digestion	Ruminant
Genotype	Proestrus	Haylage	Supplement
Haploid	Spermatogenesis	Omasum	Total Digestible Nutrients

Assessments:
Quizzes
Unit Test

Hands-On Laboratory Activities
Class Assignments
Nutrition Project
Reproduction Project

Connections to College/Career Readiness:
Objectives of this course align with those in the MxCC VET 100 and 101 courses and UCONN ECE (Companion Animal Management and Animal Behavior and Training) courses that students can take for credit through Ag 3 and Ag 4 Animal Science classes.

Resources/Materials:
Handouts
Calculators
Variety of animal species
Bedding, feed, hay
Basic nutrient samples
Animal quarters disinfectant
Dissection specimens
Neonatal care items for a variety of species
Nesting boxes for a variety of species
Guest speakers
Companion animals and livestock housed at LHS

Course Title	Farm to Fork
Agriculture Pathway	Animal Systems & Food Products and Processing Systems
Length of Course	One quarter
Ledyard High School Vision of the Graduate	Demonstrate an ability to work effectively with others, sharing ideas, acknowledging one another's strengths, and collaborating to produce presentations, projects, performances, or events. Demonstrate an ability to communicate information clearly and effectively through a variety of media, including written, oral, visual, musical, and/or video productions.
Course Overview	Farm to Fork introduces students to the food system, helps them consider their own relationship to the food system and explores how it is developed into the industrialized model that we know today. Students will explore how animals are raised for food in the industrial system and how it impacts human health and ecosystems.
Units of Study	1. Meet the Food System 2. Farmers, Factories and Food Chains 3. Consumers and Communities

	4. Food Processing and Preservation

Unit 1	Meet the Food System
Essential Questions	1. Where does my food come from and why does it matter? 2. What lessons from the history of agriculture might guide the future of our food system?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AS.02.01.04.c. Handle and work with domestic livestock, horses, and companion animals safely. AS.03.01.02.a. Differentiate between nutritional needs of animal species. AS.08.02.01.b. Critique the reliability and validity of evidence presented to support claims regarding the effects of environmental conditions on animal populations and performance (e.g., population changes, emerging species, extinction, etc.). AS.08.03.01.a. Identify and summarize methods for ensuring optimal environmental conditions for animals. CS.01.01.01.a. Examine historical and current data to identify issues impacting AFNR systems. CS.01.02.02.a. Compare and contrast AFNR systems before and after the integration of technology. CS.01.03.02.a. Identify influential historical and current public policies that impact AFNR systems. CS.03.04.01.a. Identify and differentiate the appropriate protective equipment for the safe use and operation of specific tools
Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience

Supporting Standards	
Connecticut Agriculture, Food, and Natural Resources Standards	AS.02.01.01.a. Explain the implications of animal welfare and animal rights for animal systems. AS.05.01.01.a. Differentiate between the types of facilities needed to house and produce animal species safely and efficiently.
Common Core State Standards	SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Learning Objectives	Activities	CT AFNR, NGSS, CCSS
Explore relationships among food, health, society and the environment	• Create and deliver a presentation to show how the relationship between livestock and their product provides a positive effect on humans • Create a chart that represents the supply chain for a specific livestock species from farmer to processor to consumer	AS.02.01.01.a. AS.05.01.01.a. RST.9-10.4 WHST.9-10.4 SL.9-10.4
Describe how and why agriculture was industrialized and its impact	• Complete the Food Science: An Old but New Subject Scavenger Hunt • Create a timeline showing agricultural history to document the trends within agricultural industrialization • Examine what percentage of human history has included agriculture	AS.08.02.01.b. CS.01.01.01.a. CS.01.02.02.a. CS.01.03.02.a. RST.9-10.4 WHST.9-10.4 SL.9-10.4
Work safely in the animal lab	• Feed animals according to their nutritional requirements • Monitor and replenish water supply as directed using the appropriate water container • Demonstrate proper hygiene and sanitation • Properly store animal feed in specified bins	AS.02.01.04.c. AS.03.01.02.a. AS.08.03.01.a. CS.03.04.01.a. AS.02.01.01.a. AS.05.01.01.a. SL.9-10.4

Unit 2	Farmers, Factories and Food Chains
Essential Questions	1. What can be done to raise animals in ways that are more sustainable and humane? 2. How does sustainability apply to agriculture?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AS.01.01.01.c. Evaluate the implications of animal adaptations on production practices and the environment AS.01.02.01.b. Analyze the impact of animal production methods on end product qualities (e.g., price, sustainability, marketing, labeling, animal welfare, etc.). AS.01.03.02.b. Analyze the local and global impact of sustainable animal agriculture practices on human and environmental systems. AS.02.02.01.a. Identify and categorize tools, technology and equipment used in animal husbandry and welfare to help provide an abundant and safe food supply. AS.06.03.02.b. Compare and contrast procedures to sustainably and efficiently develop an animal to reach its highest performance potential with respect to its anatomical and physiological characteristics. AS.08.01.01.a. Identify and summarize the effects of animal agriculture on the environment (e.g., waste disposal, carbon footprint, air quality, environmental efficiencies, etc.). CS.03.01.01.b. Execute health, safety and environmental procedures to comply with regulatory and safety standards.
Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics

	WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AS.05.01.02.b. Analyze the use of modern equipment, technology and handling facility procedures and determine if they enhance the safe, economic and sustainable production of animals. AS.05.02.01.b. Analyze animal facilities to determine if standards have been met. CS.04.01.02.a. Read and interpret the definition of sustainability and summarize how it relates to AFNR activities.
Common Core State Standards	SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Objectives	Activities	CT AFNR, NGSS, CCSS
Identify ways to mitigate the negative impacts of Industrial Food Animal Production or move to alternative forms of production	• Explore the pros and cons of industrial food animal production (IFAP) • Explore alternatives to IFAP through the eyes of rural communities and pasture-based farmers • Create a presentation on industrial and pasture-based approaches to producing beef, poultry, pork, dairy and eggs • Investigate what kind of animal products are available locally and how financially accessible they are	AS.01.01.01.c. AS.05.02.01.b. AS.08.01.01.a. RST.9-10.4 WHST.9-10.4 SL.9-10.4
Describe the core principles of sustainable agriculture	• Create a poster for a case study which includes: the featured farm, the crops and animals on the farm as well as the interactions among them and how the farm exemplifies agricultural qualities • Compare and contrast a variety of sustainable agriculture approaches • Design a plan for a sustainable garden or farm	AS.01.02.01.b. AS.01.03.02.b. AS.05.01.02.b. AS.06.03.02.b. CS.04.01.02.a. RST.9-10.4 WHST.9-10.4 SL.9-10.4
Analyze the advantages and disadvantages of different scales of food distribution	• Explain why and how food is transported long distances • Research the ingredients to a meal and determine where the	AS.02.02.01.a. CS.03.01.01.b.

	ingredients originated from	RST.9-10.4 WHST.9-10.4 SL.9-10.4

Unit 3	Consumers and Communities
Essential Questions	1. What should consumers know about their food? 2. How does marketing affect food choices?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AS.01.02.01.a. Identify and categorize terms and methods related to animal production (e.g., sustainable, conventional, humanely raised, natural, organic, etc.). AS.01.02.02.a. Research and examine marketing methods for animal products and services (e.g., conventional, niche markets, locally grown, etc.). AS.01.03.01.b. Analyze the structure of laws governing animal industries, international trade and animal production policies. AS.03.03.01.a. Identify and categorize tools and equipment used to meet animal nutrition needs and ensure an abundant and safe food supply. CS.06.01.02.b. Analyze AFNR systems and determine their impact on producing and processing food, fiber and fuel. ABS.04.02.02.a. Devise strategies to illustrate the production process of an AFNR business to produce a specific agricultural product. ABS.05.01.01.a. Distinguish and explain markets related to AFNR businesses (e.g., commodity markets, energy markets, etc.).

Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AS.08.02.02.c. Devise and improve plans to establish favorable environmental conditions for animal growth and performance based on a variety of factors (e.g., economic feasibility, environmental sustainability, impact on animals, etc.).
Common Core State Standards	SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Objectives	Activities	CT AFNR, NGSS, CCSS
Identify who regulates and verifies the accuracy of food labels	• Explore which labels on food packages are regulated, which are trustworthy and which are used as marketing tools • Design the packaging for a product including the labeling requirements • Research and present the information on who regulates food labels • Track the kinds of claims found on food labels throughout a week and keep a journal with the findings	AS.01.02.01.a. AS.01.03.01.b. RST.9-10.4 WHST.9-10.4 SL.9-10.4
Describe how food marketing influences food choices	• Research advertisements promoting agricultural products and present the findings • Design a marketing campaign for consuming healthy food • Compare and contrast marketing history for an agricultural product and describe how the marketing strategy evolved	AS.01.02.01.a. AS.01.02.02.a. ABS.04.02.02.a. ABS.05.01.01.a RST.9-10.4 WHST.9-10.4 SL.9-10.4
Identify how changing food environments could	• Explore factors that influence food choices	AS.03.03.01.a.

promote healthier diets	• Describe the food environment at our school and create a list of suggestions to propose to administration	AS.08.02.02.c. RST.9-10.4 WHST.9-10.4 SL.9-10.4
Identify strategies to reduce food waste	• Create a proposal for a program to reduce food waste at LHS • Conduct a food waste audit at LHS and/or at home • Create a campaign to motivate peers to reduce food waste • Create and maintain a compost pile at home or at school	AS.03.03.01.a. CS.06.01.02.b. RST.9-10.4 WHST.9-10.4 SL.9-10.4
Analyze interventions for reducing hunger and food insecurity	• Explore how the power of engaged citizens to change the food system through policy • Design an intervention to address a food system problem • Identify allies who could help implement the intervention	CS.06.01.02.b. RST.9-10.4 WHST.9-10.4 SL.9-10.4

Unit 4	Food Processing & Preservation
Essential Questions	1. Why is studying the effects of foodborne illnesses important? 2. How can you preserve a variety of foods?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	FPP.01.01.01.a. Research and summarize the purposes and objectives of safety programs in food products and processing facilities (e.g., Sanitation Standard Operating Procedures (SSOP); Good Manufacturing Practices (GMP); worker safety, etc.) FPP.01.01.02.a. Research and categorize types of equipment used in food products and processing systems. FPP.01.02.01.c. Identify sources of contamination in food products and/or processing facilities and develop ways to eliminate contamination. FPP.01.03.01.a. Identify and summarize purposes of food storage procedures (e.g., first in/first out, temperature regulation, monitoring, etc.). FPP.01.03.02.b. Demonstrate and explain methods of documentation procedures within food products and processing systems.

	FPP.02.01.01.a. Research and summarize properties of common food constituents (e.g., proteins, carbohydrates, fats, vitamins, minerals). FPP.03.02.01.b. Compare weights and measurements of products and perform conversions between units of measure FPP.03.02.03.a. Identify methods of food preservation and give examples of foods preserved by each method.
Common Core State Standards	MP.4. Model with mathematics. RI.2. Determine a central idea of a text and analyze its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary of the text.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	FPP.01.02.03.b. Design and construct experiments for quality assurance tests on food products. FPP.02.02.01.c. Design and conduct experiments to determine the chemical and physical properties of food products. FPP.02.02.02.a. Identify common food additives and identify their properties (e.g., preservatives, antioxidants, buffers, stabilizers, colors, flavors, etc.). FPP.02.03.01.a. Examine and explain the importance of food labeling to the consumer. FPP.03.01.04.a. Identify and describe foods derived from different classifications of food products (e.g., meat, egg, poultry, fish, dairy, fruits, vegetables, grains, legumes, oilseeds, etc.). FPP.03.02.04.a. Summarize types of materials and methods used in food packaging and presentation.
Common Core State Standards	W.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. SL.4. Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Objectives	Activities	CT AFNR, NGSS, CCSS
Research the Sanitation Standard Operating Procedures (SSOP) and Good Manufacturing Practices (GMP)	• Demonstrate methods of documentation • Outline procedures to follow for SSOP & GMP • Maintain equipment/tools and facilities for proper sanitation	FPP.01.01.01.a. FPP.01.03.02.b. RI.2. W.4. SL.4.
Safely use and categorize food processing equipment	• Maintain proper food storage procedures • Use a variety of food processing equipment	FPP.01.01.02.a. FPP.01.03.01.a. SL.4.

Identify sources of contamination and develop ways to eliminate contamination	• Create experiments for quality assurance tests on food products • Research, identify and describe the effects of food-borne pathogens have on food products and humans • Explore how public health officials respond to foodborne illness outbreaks • Create a list of interventions to improve food safety	FPP.01.02.01.c. FPP.01.02.03.b. RI.2 W.4. SL.4.
Apply principles of nutrition to develop food products	• Identify the common food constituents • Conduct experiments to determine chemical and physical properties of food products • Identify and use common food additives • Create food labels for food products • Identify and explain foods that originate from a variety of food products • Calculate the measurements of the products to utilize while cooking • Preserve a variety of foods using various methods and techniques	FPP.02.01.01.a FPP.02.02.01.c. FPP.02.03.01.a FPP.03.01.04.a FPP.03.02.01.b. FPP.03.02.03.a. FPP.03.02.04.a. MP.4. RI.2 W.4. SL.4.
Perform a variety of food processing techniques	• Make a variety of canned foods (pickles, jellies etc) • Make ice cream, butter and yogurt • Make sausage	

Vocabulary:

Antioxidant	Foodborne illness	Organic
Carbon footprint	Humanely raised	Preservative
Commodity market	Marketing	Stabilizers
Consumer	Mitigate	Supply chain
Energy market	Niche market	Sustainability

Assessments:
Evaluations
Hands-On Laboratory Activities

Class Assignments

Connections to College/Career Readiness:
ServSafe Certification

Resources/Materials:
John Hopkins Center for Livable Future- Food Span
CDC Foodborne Germs and Illnesses
www.servsafe.com
Variety of food processing equipment (sausage maker, ice cream maker, etc)

Course Title	Laboratory Animal Science
Agriculture Pathway	Animal Systems
Length of Course	One Quarter
Ledyard High School Vision of the Graduate	Demonstrate an ability to work effectively with others, sharing ideas, acknowledging one another's strengths, and collaborating to produce presentations, projects, performances, or events. Demonstrate critical thinking skills to find solutions, support arguments, and overcome challenges in a variety of content areas. Demonstrate an ability to solve problems of varying complexity across a variety of content areas.

Course Overview	This course will provide students with background information on the care and use of animals in a laboratory setting. They will discover the many ways humans and other animals have benefitted from the use of animals in a laboratory setting. Students will learn about the proper care of animals in laboratory settings and how the industry is regulated. They will demonstrate care techniques including implementation enrichment activities. Students will prepare a presentation on specific discoveries made through the use of a variety of species of animals. They will design their own experiments and conduct research. Students will learn about the many employment opportunities within the field and associated certifications.
Units of Study	1. Care and use of Animals in a Laboratory Setting 2. History and Purpose of Laboratory Animal Science 3. Experimental Design and Methodology

Unit 1	Care and use of Animals in a Laboratory Setting
Essential Questions	1. How do standards of care for animals used in biomedical research differ from standards of care you are already familiar with? 2. How does facility and housing design impact animal welfare in a laboratory setting?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AS.02.01.04.c. Handle and work with domestic livestock, horses, and companion animals safely. AS.02.01.03.b. Analyze and document animal husbandry practices and their impact on animal welfare. AS.05.02.02.a. Distinguish between the types of laws and regulations pertaining to animal systems
Common Core State Standards	RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AS.02.01.02.b. Analyze and document animal welfare procedures used to ensure safety and maintain low stress when moving and restraining animals. AS.02.02.01.b. Utilize tools, technology and equipment to perform animal husbandry and welfare tasks. AS.05.02.01.b. Analyze animal facilities to determine if standards have been met. AS.07.01.03.b. Identify and describe common illnesses and disorders of animals based on symptoms and problems caused by wounds, diseases, parasites and physiological disorders. CS.01.01.01.a. Examine historical and current data to identify issues impacting AFNR systems.
Common Core State Standards	WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

Learning Objectives	Activities	CT AFNR, NGSS, CCSS
Discuss how animal welfare legislation and committees have impacted the use of animals in a laboratory setting.	● Research the history of the Animal Welfare Acts ● Investigate the purpose and importance of the Institute of Animal Care and Use Committee (IACUC) ● Explore the purpose, objectives, goals and mission of the American Association for Laboratory Animal Science (AALAS) ● Investigate federal, Connecticut and local regulations	AS.05.02.02.a. CS.01.01.01.a. RST.9-10.4.

	pertaining to laboratory animals and the sources of additional and current regulatory information	
Demonstrate the minimum level of care standards for animals housed in a laboratory setting.	• Investigate the housing requirements of various species of laboratory animals and compare these standards to housing facilities at the school • Observe and report alterations in the animal room environment including temperature, air exchange, light/dark cycles and humidity • Recognize common signs of clinical illness in laboratory animals • Provide care for laboratory animals in a safe and sanitary manner using equipment under established protocols • Handle, restrain and determine the sex of common laboratory animals • Assist with various methods of animal identification and record keeping • Observe and report irregularities in laboratory animals, including variations in dietary habits, abnormal stool or urine specimens, unusual behaviors and deaths • Tour (in person or virtually) at laboratory animal facility • Design and provide appropriate enrichment activities that are also utilized in a laboratory setting to the program animals • Discuss ethical issues surrounding the use of animals in laboratory research and how they are being addressed by the industry (The Three R's)	AS.02.01.04.c. AS.02.01.02.b. AS.02.01.03.b. AS.02.02.01.b. AS.05.02.01.b. AS.07.01.03.b. CS.01.01.01.a. WHST.9-10.2. RST.9-10.4.

Unit 2	History and Purpose of Laboratory Animal Science
Essential Questions	1. Why do we use animals in research? 2. How has the use of animals in research impacted human health?

	3. Why should I consider a career in laboratory animal science?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CRP.04.01.02.b. Apply strategies for speaking with clarity, logic, purpose and professionalism in a variety of situations in formal and informal settings. CRP.04.02.02.c. Compose clear and coherent written documents and visuals (e.g., agendas, audio-visuals, drafts, forms, etc.) that are adapted to the audience needs in both formal and informal settings.
Common Core State Standards	SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	CS.05.01.02.a. Examine the educational, training and experiential requirements to pursue a career in an AFNR pathway (e.g., degrees, certifications, training, internships, etc.)
Common Core State Standards	WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

Objectives	Activities	CT AFNR, NGSS, CCSS
Discuss when animals were first used and why they continue to be used in scientific research	• Create a timeline of scientific discoveries that were made through the use of animals • Play a jeopardy game focused on historical discoveries through	CRP.04.01.02.b. WHST.9-10.9

	the use of animals in research ● Research the origin of today's research animals and identify genetic traits specific to research purposes ● Conduct research/interviews to gauge public perception of animals in research and present data/findings ● Create information brochures to educate the benefits of animal use in research	
Identify discoveries that have been made through the use of animals in biomedical research	● Explore a specific laboratory animal species and create a scientific poster to teach others about the many outcomes of research using that animal ● Participate in a science fair-type display and present your findings to others	CRP.04.02.02.c. CRP.04.01.02.b. SL.9-10.4
Explore various career opportunities in laboratory animal science	● Differentiate between the levels of AALAS certification (ALAT, LAT, LATG) ● Create a brochure for a specific career in laboratory animal science ● Interview laboratory animal science professionals	CRP.04.02.02.c. CS.05.01.02.a. WHST.9-10.9

Unit 3	Experimental Design and Methodology

Essential Questions	1. How do I properly design an experiment? 2. How do I collect, analyze and interpret data?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CRP.04.02.02.c. Compose clear and coherent written documents and visuals (e.g., agendas, audio-visuals, drafts, forms, etc.) that are adapted to the audience needs in both formal and informal settings. CRP.08.01.01.a. Identify and summarize steps to think critically (e.g., identify problem, gather information, brainstorm solutions, etc.). BS.02.01.01.b. Maintain and interpret laboratory records documented in a laboratory to ensure data accuracy and integrity (e.g., avoid bias, record any conflicts of interest, avoid misinterpreted results, etc.).
Common Core State Standards	WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research. WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AS.02.02.01.b. Utilize tools, technology and equipment to perform animal husbandry and welfare tasks. CRP.07.02.01.b. Assess data sources for reliability and validity.
Common Core State Standards	WHST.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Objectives	Activities	CT AFNR, NGSS, CCSS

Discuss the scientific method	• Create a flowchart for the scientific method • Differentiate between descriptive, comparative and experimental investigation	CRP.08.01.01.a. WHST.9-10.9 RST.9-10.4.
Identify the required components of a research proposal	• Conduct background research into a laboratory animal science topic • Design an experiment using the program animals • Write a research proposal that clearly justifies the use of animals in research	CRP.04.02.02.c. AS.02.02.01.b. CRP.07.02.01.b. WHST.9-10.9 WHST.9-10.4 RST.9-10.3.
Evaluate the quality of a research experiment	• Collect, analyze and interpret data for an experiment • Identify study improvements or secondary experiments that would contribute additional knowledge on the topic	BS.02.01.01.b. WHST.9-10.4 WHST.9-10.7 RST.9-10.3.

Vocabulary:

AALAS (American Association for Laboratory Animal Science)
ALAT (Assistant Laboratory Animal Technician)
Animal Welfare Act
Biomedical
Enrichment
Experimental Design
IACUC (Institutional Animal Care and Use Committee)
LAT (Laboratory Animal Technician)
LATG (Laboratory Animal Technologist)
Scientific Method
The Three R's: replacement, refinement, reduction

Assessments:
Lab activities
Class assignments
Quizzes
Project

Connections to College/Career Readiness:
Objectives of this course align with objectives of the ALAT Training Manual
Objectives of this course align with those in the MxCC VET 100 and 101 courses that students can take for credit through Ag 3 and Ag 4 Animal Science classes.

Resources/Materials:
Companion animals and livestock housed at LHS
Cleaning tools and supplies (scrub brushes, disinfectants, etc.)
Restraint devices, tools and equipment
Experimental materials that students request in proposals
Microscopes
Centrifuge
Microscope slides, pipettes and other typical laboratory supplies
AALAS Learning Library
Office of Laboratory Animal Welfare

Course Title	Recirculating Systems Aquaculture
Agriculture Pathway	Aquaculture Systems Career Pathway
Length of Course	One Quarter
Ledyard High School Vision of the Graduate	Demonstrate an ability to work effectively with others, sharing ideas, acknowledging one another's strengths, and collaborating to produce presentations, projects, performances, or events. Demonstrate critical thinking skills to find solutions, support arguments, and overcome challenges in a variety of content areas. Demonstrate an ability to solve problems of varying complexity across a variety of content areas.
Course Overview	This unit covers the basic design and management practices of closed recirculating systems aquaculture. Students learn essential techniques in maintaining a healthy environment for finfish and other aquatic organisms used in aquaculture production. Practical applications such as measuring water quality, basic plumbing, fish acclimation and transport, safe equipment use, and maintenance of production systems are used to support instruction. Students further apply principles of filtration and water quality by planning, constructing and assessing a small scale model of a functional recirculating system.
Units of Study	1. Properties of Recirculating Systems 2. Principles of Filtration, Water Movement and Aeration in Recirculating Systems 3. Water Testing Safety and Assessment 4. Production Species 5. Recirculating Systems Design and Maintenance

Unit 1	Properties of Recirculating Systems
Essential Questions	1. How does a recirculating system function? 2. Why are recirculating systems used in the aquaculture industry?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.07.01.01.a. List and describe various hatchery systems; ponds, raceways, tanks, etc. AQ.08.01.01.a. Describe the world's water supplies and discuss the many uses of water AQ.08.02.01.b. Diagram the steps in wastewater treatment. AQ.09.01.01.a. Identify the following types of aquaculture systems: raceways, ponds, recirculating systems, and net pens or cages. AQ.09.01.02.a. Identify equipment and handling facilities used in modern aquaculture production. AQ.09.01.03.b. Explain the basic electrical, plumbing and mechanical components of aquaculture systems. AQ.14.03.06.c. Analyze management practices that will reduce TAN in aquaculture systems.
Common Core State Standards	RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.01.03.02.a. Research and summarize sustainability in aquaculture systems. AQ.02.01.02.a. Research and summarize the challenges involved in working with aquatic animals and resources available to overcome them (e.g., tools, technology, equipment, facilities, animal behavior signals, etc.). AQ.08.01.04.b. Describe precautions taken to prevent/reduce contamination of groundwater supplies. AQ.14.03.02.c. Demonstrate methods of correcting dissolved oxygen deficiency in aquaculture systems.
Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Learning Objectives	Activities	CT AFNR, NGSS, CCSS
Explore recirculating systems aquaculture	● Review and explore the numerous methods of aquaculture ● Compare and contrast the role of recirculating systems in aquaculture production ● Outline the advantages and disadvantages of recirculating system in contrast to other methods	AQ.01.03.02.a. AQ.02.01.02.a AQ.07.01.01.a. AQ.09.01.01.a. AQ.09.01.02.a. AQ.09.01.03.b WHST.9-10.4
Identify and describe the three primary components of a recirculating system	● Label and define the components of a recirculating system. ● Trace the water path and water movement through the lab recirculating systems ● Explicate the function and use of each component ● Identify the lab systems components	AQ.08.02.01.b. AQ.09.01.01.a. AQ.09.01.03.b AQ.14.03.02.c. AQ.14.03.06.c. WHST.9-10.4 RST.9-10.4
Compare and contrast filtration principles uses in common applications	● Review the filtration cycle of municipal waste water and source water ● Outline the basic filtration principles used in domestic aquariums ● Compare and contrast the filtration principles and water movement used in household water with those of aquatic systems	AQ.07.01.01.a. AQ.08.02.01.b AQ.08.01.04.b. AQ.08.02.01.b. AQ.09.01.02.a. WHST.9-10.4 RST.9-10.4
Basic maintenance and care of a recirculating system	● Outline the basic maintenance tasks of a recirculating system ● Perform the basic maintenance tasks under guidance and supervision of instructor ● Identify and diagnose basic problems or atypical occurrences in a functioning system ● Outline and describe the basis of the maintenance requirements of an aquatic system	AQ.08.02.01.b. AQ.09.01.01.a. AQ.14.03.06.c. WHST 11-12.4

Unit 2	Principles of Recirculating Systems: Filtration, Water Movement and Aeration
Essential Questions	1. How does water move efficiently through a recirculating system? 2. What are the filtration requirements of a recirculating system? 3. What are the aeration requirements of a recirculating system?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.09.01.02.a. Identify equipment and handling facilities used in modern aquaculture production. AQ.09.01.03.a. Identify and describe the following parts of a recirculating aquaculture system (RAS): tank, sump or reservoir, pump, solid waste filter, U/V sterilizer, heat exchanger, bio-filter, and aeration. AQ.09.01.03.b. Explain the basic electrical, plumbing and mechanical components of aquaculture systems. AQ.09.01.04.a. Describe how the bio-filter of a recirculating aquaculture system (RAS) converts ammonia to nitrite, and nitrite to nitrate. AQ.09.01.04.b. Diagram the nitrogen cycle in relation to aquaculture. AQ.14.03.02.a. Discuss factors that affect dissolved oxygen levels in aquaculture systems AQ.14.03.02.c. Demonstrate methods of correcting dissolved oxygen deficiency in aquaculture systems. AQ.14.03.06.c. Analyze management practices that will reduce TAN in aquaculture systems.
Common Core State Standards	WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience MP1 Make sense of problems and persevere in solving them. MP2 Reason abstractly and quantitatively.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.05.01.01.a. Explain methods of determining aquatic species health and disorders. AQ.05.01.03.a. Explain characteristics of causative agents and vectors of diseases and disorders in aquatic species. AQ.14.03.08.b. Explain methods to control weeds and algae in aquaculture systems.

Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. MP1 Make sense of problems and persevere in solving them. MP2 Reason abstractly and quantitatively.

Objectives	Activities	CT AFNR, NGSS, CCSS
Describe the water movement and devices used in a recirculating system	• Outline and describe with the following water movement methods: siphon, gravity, airlift, and pumps. • Identify and define the equipment associated with water movement • Compare and contrast the advantages and disadvantages of each water movement method • Experiment with each method of water movement using tubing, containers and aquaculture equipment • Measure, test and improve water flow using experimentation of different methods and equipment	AQ.09.01.02.a. AQ.09.01.03.a. AQ.09.01.03.b. AQ.14.03.02.a. AQ.14.03.06.c. WHST.9-10.4
Identify and describe the methods of mechanical filtration to remove solids in a recirculating system	• Discuss and differentiate the methods and importance of particle collection and removal in aquariums and recirculating system • Experiment with various methods of particle collection using basic aquaculture supplies and equipment • Identify and define the equipment associated with mechanical filtration • Outline and describe the methods of particle collection in production facilities • Explore the lab systems methods of mechanical filtration • Perform the basic maintenance on the lab's mechanical filters	AQ.05.01.01.a AQ.05.01.03.a. AQ.09.01.02.a. AQ.09.01.03.a. AQ.09.01.03.b. AQ.14.03.06.c.
Identify and describe the methods of biological filtration in a recirculating system	• Identify and define the equipment associated with biological filtration • Diagram Nitrogen Cycle in relation to both a natural aquatic system and an recirculating system • Describe and outline the methods and importance of biological filtration in recirculating systems aquaculture • Explore the components and functions of a typical biofilter including water flow, movement, biomedia and aeration • Explore the factors that affect the nitrogen cycle in a closed aquatic system	AQ.05.01.01.a AQ.05.01.03.a. AQ.09.01.02.a. AQ.09.01.03.a. AQ.09.01.03.b. AQ.09.01.04.a. AQ.09.01.04.b. AQ.14.03.02.a. AQ.14.03.08.b WHST 9-10.4

	• Define and explain a 'cycled' system • Test for specific levels of Ammonia, Nitrite and Nitrate to determine a 'cycled' system • Explore the lab systems methods of biological filtration • Perform the basic maintenance on the labs biofilters	MP1 MP2
Identify and describe the aeration components of a recirculating system	• Discuss and differentiate the methods and importance of aeration in aquariums and recirculating system • Experiment with various methods of aeration using basic aquaculture supplies and equipment • Identify and define the equipment associated with dissolved oxygen and aeration • Explore the oxygen budget in a recirculating system and the methods of management • Outline and describe the methods of aeration, dissolved oxygen and degassing in production facilities • Explore the lab systems methods of aeration and degassing • Perform a basic check on the lab's aeration devices • Perform a Dissolved Oxygen test	AQ.09.01.02.a. AQ.09.01.03.a. AQ.09.01.03.b. AQ.14.03.02.a. AQ.14.03.02.c. MP1 MP2

Unit 3	Water Testing Safety and Assessment
Essential Questions	1. What are the procedures used to safely and accurately acquire and test the water in an aquatic system? 2. What key water parameters should be tested to determine the health of a recirculating system?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.09.01.04.b. Diagram the nitrogen cycle in relation to aquaculture. AQ.09.03.01.b. Describe risks related to hazardous materials and describe health and safety practices to reduce risks from hazardous materials. AQ.14.03.01.a. Identify water quality factors that are important in aquaculture systems. AQ.14.03.01.b. Describe the water quality factors most likely to be involved with aquaculture losses. AQ.14.03.01.c. Demonstrate proper technique for taking water samples to perform water quality assessments AQ.14.03.02.a. Discuss factors that affect dissolved oxygen levels in aquaculture systems AQ.14.03.02.b. Conduct dissolved oxygen test. Analyze and record test results. AQ.14.03.04.b. Take, record and analyze pH measurements. ESS.05.02.01.c. Evaluate a sample of water to determine its quality and if it has been contaminated.
Common Core State Standards	WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS3-4),(HS-PS3-5) RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics MP2 Reason abstractly and quantitatively.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.05.01.01.a. Explain methods of determining aquatic species health and disorders. AQ.05.01.03.a. Explain characteristics of causative agents and vectors of diseases and disorders in aquatic species. AQ.14.01.01.a. Identify sources of water for aquaculture enterprises. AQ.14.03.03.a. Explain the importance of water temperature in aquaculture systems. CS.06.02.01.a. Use proper safety practices/personal protective equipment.
Common Core State Standards	MP1 Make sense of problems and persevere in solving them.

Objectives	Activities	CT AFNR, NGSS, CCSS
Safely and accurately acquire and test a water sample from an aquatic system	• Outline the safety procedures used when acquiring and testing a water sample • Disclose the location of the chemicals used in testing and their corresponding SDS sheets • Locate, read and interpret SDS for water testing reagents • Safely perform water tests according to instruction and classroom guidelines • Determine and record specific chemical levels based on water test results • Assess water quality by recording and analyzing results of the water tests • Discuss environmentally sound practices for disposal of wastewater and water testing chemicals.	AQ.05.01.03.a. AQ.09.03.01.b. AQ.14.01.01.a. AQ.14.03.01.a. AQ.14.03.01.b. AQ.14.03.01.c. AQ.14.03.02.a. CS.06.02.01.a. ESS.05.02.01.c. WHST.9-12.9 RST.9-10.4 MP1 MP2
Record and compare water quality data	• Use spreadsheets to record and assess water parameters over a period of time • Provide an overall analysis of the water quality based on test results • Identify and analyze common trends of water quality using test results • Propose appropriate treatment for recirculating system based on water test results and assessments	AQ.09.01.04.b. AQ.14.03.01.a. AQ.14.03.03.a. AQ.14.03.02.b. AQ.14.03.04.b. WHST 9-10.4 RST.9-10.4 MP1 MP2
Test and track the water parameters of the nitrogen cycle	• Describe and diagram the Nitrogen cycle and its role in biological filtration • Test for all forms of Nitrogen (Ammonia, Nitrite and Nitrate),	AQ.05.01.01.a AQ.09.01.04.b. AQ.14.03.01.a.

	dissolved oxygen and pH in a recirculating system ● Analyze water test results to conclude, in writing, biological filtration and cycling in a recirculating system ● Graph the nitrogen cycle over a period of time to correlate common trends in cycling ● Provide recommendations for the improvement of water quality bases on results	AQ.14.03.01.b. AQ.14.03.02.a. AQ.14.03.02.b. AQ.14.03.04.b. CS.06.02.01.a. WHST.9-12.9 RST.9-10.4 MP1 MP2

Unit 4	Production Species
Essential Questions	1.What are the common species used in recirculating systems aquaculture? 2. What species can we raise in our current aquaculture lab?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.01.01.01.b. Evaluate and describe characteristics of aquatic organisms that developed in response to the aquatic specie's environment and led to their commercial use. AQ.03.01.01.c. Demonstrate the proper formatting and usage of binomial nomenclature. AQ.04.01.06.b. Compare and contrast body systems and system adaptations between aquatic species. AQ.04.02.03.a. Describe the life cycle of aquaculture species.
Common Core State Standards	WHST 11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.03.01.02.a. Classify species of aquatic organisms as fresh water, marine, or diadromous, and by their genus and species AQ.04.01.03.a. Describe the basic functions of aquatic species cells in growth and reproduction.

Objectives	Activities	CT AFNR, NGSS, CCSS
Identify common production species used in recirculating aquatic systems	• Identify and research common aquatic species used in recirculating systems • Distinguish the ideal traits of aquatic species used in recirculating systems • Identify common aquaculture species by their binomial name • Identify the aquatic species in the aquaculture lab's recirculating systems	AQ.01.01.01.b. AQ.03.01.01.c. AQ.03.01.02.a. AQ.04.01.06.b. AQ.04.02.03.a. WHST.9-10.4
Determine the ideal water parameter ranges for specific aquatic species	• Compare the water parameters and tolerance ranges of specific aquatic species • Test and adjust water parameters in accordance with a specific aquatic species	AQ.01.01.01.b. AQ.04.01.06.b. AQ.04.02.03.a.

Unit 5	Recirculating Systems Design and Maintenance
Essential Questions	1. What are the proper maintenance protocols for managing a recirculating system? 2. How can one build a successful recirculating system?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.09.01.03.a. Identify and describe the following parts of a recirculating aquaculture system (RAS): tank, sump or reservoir, pump, solid waste filter, U/V sterilizer, heat exchanger, bio-filter, and aeration. AQ.09.01.03.b. Explain the basic electrical, plumbing and mechanical components of aquaculture systems. AQ.09.01.03.c. Construct a recirculating aquaculture system (RAS) based on dynamic interaction including flow rate, size, capacity, plumbing, friction loss, species and component requirements. AQ.09.01.04.c. Design and construct a functional bio filtration system. AQ.10.01.02.a. Repair and maintain vehicles, vessels, tools and equipment. AQ.14.03.01.a. Identify water quality factors that are important in aquaculture systems. AQ.14.03.01.b. Describe the water quality factors most likely to be involved with aquaculture losses. CS.08.01.01.c. Use tools and equipment appropriately to complete a specific task.
Common Core State Standards	WHST.9-10.1.e Provide a concluding statement or section that follows from or supports the argument presented. WHST.9-102.2a Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension WHST 9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience MP 4 Model with mathematics

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.05.02.01.a. Explain the importance of biosecurity to the aquaculture industry. AQ.10.01.01.a. Identify vehicles, vessels, tools and equipment used for aquaculture. AQ.14.03.08.b. Explain methods to control weeds and algae in aquaculture systems.
Common Core State Standards	RST.9-102.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics MP 5 Use appropriate tools strategically

Objectives	Activities	CT AFNR, NGSS, CCSS
Plan, design, construct and assess a functional model recirculating system	• Work in a group design and plan a model recirculating system including water movement, filtration components, and aeration • Use the proper tools and equipment to construct a prototype system • Use plans and proper tools and materials to construct a fully functional model of a recirculating system • Determine volume of system for pump and filter sizing • Journal and assess procedures in the planning, design and construction of the system • Diagnose and troubleshoot occurrences and complications during the construction and monitoring of the project • Present the final system using electronic presentation platforms of student choice	AQ.09.01.03.a. AQ.09.01.03.b. AQ.09.01.03.c. AQ.09.01.04.c. AQ.10.01.02.a. CS.08.01.01.c. WHST.9-10.1.e WHST.9-10.2a WHST.9-10.4 MP 4 MP 5
Analyze water parameters for the introduction of an aquatic species	• Cycle and track the water quality using water testing and analysis • Journalize water parameters to map trends in the nitrogen cycle • Acclimate and introduce production species to model recirculating system • Monitor and journal water quality after acclimation of species	AQ.05.02.01.a. AQ.14.03.01.a. AQ.14.03.01.b. WHST.9-10.1.e MP 5

Perform the necessary maintenance tasks on lab and model recirculating systems	• Demonstrate appropriate maintenance and equipment use of a recirculating system • Demonstrate proper use, care and sanitation of aquaculture equipment • Develop and implement a maintenance schedule for a specific lab system • Perform specific system checks based on lab maintenance and requirements	AQ.09.01.03.a. AQ.09.01.03.b. AQ.10.01.01.a. AQ.10.01.02.a. AQ.14.03.08.b. CS.08.01.01.c.

Vocabulary:

Airlift	Coupling	Nitrosomonas
Ammonia	Cycling	Nitrospira
Binomial Nomenclature	Dissolved Oxygen	Production Tank
Biofilter	Filter Fiber	Poly Vinyl Chloride (PVC)
Bioreactor	Gasket	Recirculating System
Biofiltration	Gravity Fed	Settling Tank
Biomedia	Mechanical Filtration	Siphon
Bulkhead Fitting	Nitrate	Stand Pipe
Chemical Filtration	Nitrite	Submersible Pump
Clarifier	Nitrogen Cycle	Vortex Filter

Assessments:
Assignments
Quizzes
Practical Work Rubric for systems maintenance
Water Analysis Assessments
Project Journal
Project Construction and Systems Assessments

Connections to College/Career Readiness:

Resources/Materials:
Aquatic Systems Engineering: Devices and How they Function
Fundamentals of Aquaculture: Step by Step Guide to Commercial Aquaculture
Text: Aquaculture Science, Second Edition. Parker. Delmar, 2002
SRAC (Southern Regional Aquaculture) Publications
Recirculating Systems Equipment and Materials: Plumbing Tools, PVC plumbing materials/adhesives, submersible pumps, aerators, tubing and air stones
Water Testing Safety Equipment and Kits
Access to recirculating systems equipment, systems and species

Course Title	Aquaponics
Agriculture Pathway	Aquaculture Systems
Length of Course	One Quarter
Ledyard High School Vision of the Graduate	Communicate information clearly and effectively in a variety of settings Demonstrate critical thinking and problem solving skills effectively Employ effective research and study skills
Course Overview	This unit covers the basic principles, design and management of aquaponics systems. The unit begins with the techniques used in aquaculture systems and ties them with horticulture and hydroponics. We will explore the various methods of traditional and modern aquaponics. Students will then use this information to design and construct an urban aquaponics system to integrate into an existing classroom or lab system. Students will closely monitor water quality, plant growth and fish health to maximize production and efficiency.
Units of Study	1. Principles of Filtration, Water Movement and Aeration in Aquatic Systems 2. Aquaponics Systems: Methods and Techniques

Approved by Instructional Council on May 31, 2023

	3. Water Testing and Analysis 4. Aquaponics design and maintenance

Unit 1	Principles of Filtration, Water Movement and Aeration in Aquatic Systems
Essential Questions	1. What are the basic principles of water movement, filtration and aeration in a recirculating system? 2. What are the basic principles of water movement, filtration and aeration in an aquarium?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.09.01.02.a. Identify equipment and handling facilities used in modern aquaculture production. AQ.09.01.03.a. Identify and describe the following parts of a recirculating aquaculture system (RAS): tank, sump or reservoir, pump, solid waste filter, U/V sterilizer, heat exchanger, bio-filter, and aeration. AQ.09.01.04.a. Describe how the bio-filter of a recirculating aquaculture system (RAS) converts ammonia to nitrite, and nitrite to nitrate. AQ.09.01.04.b. Diagram the nitrogen cycle in relation to aquaculture. AQ.14.03.02.a. Discuss factors that affect dissolved oxygen levels in aquaculture systems
Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics

Supporting Standards	
Connecticut Agriculture, Food, and Natural Resources Standards	AQ.09.01.03.b. Explain the basic electrical, plumbing and mechanical components of aquaculture systems. AQ.14.03.02.c. Demonstrate methods of correcting dissolved oxygen deficiency in aquaculture systems. AQ.14.03.06.c. Analyze management practices that will reduce TAN in aquaculture systems.
Common Core State Standards	WHST 9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience MP1 Make sense of problems and persevere in solving them. MP2 Reason abstractly and quantitatively.

Objectives	Activities	CT AFNR, NGSS, CCSS
Identify and contrast the filtration equipment and methods used in recirculating and aquarium systems	• Identify and describe in writing the function of specific filtration equipment used in an aquatic system • Outline the typical layout of a recirculating system detailing filtration devices and water movement • Outline the typical layout of a recirculating system detailing filtration devices and water movement • Practice the safe use of common equipment used in aquaculture systems • Interpret the methods of mechanical filtration to remove solids in a recirculating system • Interpret the methods of biological filtration in a recirculating system	AQ.09.01.02.a. AQ.09.01.03.b. AQ.09.01.04.a. AQ.09.01.04.b. AQ.14.03.06.c. RST.9-10.4
Analyze and compare the movement and circulation of water through recirculating and aquarium systems	• Identify and define the equipment associated with water movement and flow • Outline and describe with the following water movement methods: siphon, gravity, airlift, and pumps	AQ.09.01.02.a. AQ.09.01.03.a. AQ.09.01.03.b. RST.9-10.4

	• Observe and experiment with various techniques of water movement • Measure, test and improve water flow using experimentation. • Compare and contrast methods of water movement through different types of containers, elevations and plumbing	WHST 9-10.4
Identify and contrast the aeration components in aquatic systems	• Demonstrate and describe the importance and necessity of Dissolved Oxygen in both aquaculture systems and aquaponics systems • Discuss and differentiate the methods of aeration in aquariums and recirculating systems • Identify and define the equipment associated with dissolved oxygen and aeration • Explore the oxygen budget in a common aquatic system • Experiment with methods of aeration and degassing using aquaculture equipment • Perform water tests and compare results of Dissolved Oxygen using test kits and D.O. meters	AQ.09.01.02.a. AQ.09.01.03.a. AQ.09.01.03.b. AQ.14.03.02.a. AQ.14.03.02.c. RST.9-10.4 MP1 MP2

Unit 2	Aquaponics Systems: Methods and Techniques
Essential Questions	1. What are the types of systems used in modern aquaponics? 2. What are the components and methods used in aquaponics systems?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.01.03.02.a. Research and summarize sustainability in aquaculture systems. AQ.09.01.02.a. Identify equipment and handling facilities used in modern aquaculture production. AQ.09.01.03.b. Explain the basic electrical, plumbing and mechanical components of aquaculture systems. AQ.15.01.01.a. Define aquaponics. AQ.15.01.01.b. Describe species of plants and animals suited for aquaponics. AQ.15.01.02.b. Describe favorable attributes for plant species used in aquaponics AQ.15.01.02.c. Choose plant species for use in an aquaponics system. AQ.15.01.04.c. Choose aquatic animal species for use in an aquaponics system. AQ.15.01.05.b. Compare and contrast the following aquaponics systems; Float, Flood-and-Drain and Nutrient Film Technique

	(NFT). AQ.15.01.08.b. Discuss how aquaponics is sustainable.
Common Core State Standards	WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience SL.9-10.5 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. MP3 Construct viable arguments and critique the reasoning of others.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.08.01.05.b. Explain how aquaponics can be utilized to enhance sustainable aquaculture practices by reducing water consumption and waste production. AQ.09.01.01.b. Critique designs for an aquaculture facility and prescribe alternative layouts and adjustments for the safe and efficient use of the facility. AQ.09.01.04.a. Describe how the bio-filter of a recirculating aquaculture system (RAS) converts ammonia to nitrite, and nitrite to nitrate. AQ.14.01.01.b.Compare and contrast different water sources for aquaculture enterprises. AQ.15.01.02.b. Describe favorable attributes for plant species used in aquaponics
Common Core State Standards	RST.9-10.4 Determine the meaning of words and phrases as they are used in text, including analyzing how an author uses and refines the meaning of a key term over the course of a text

Objectives	Activities	CT AFNR, NGSS, CCSS
Define Aquaponics and Sustainable Aquaculture and its role in Agriculture	• Explore Aquaculture, Horticulture and Hydroponics to compare and contrast components used in each • Discuss the sustainable methods used in modern agriculture, specifically aquaponics • Discuss the resources and energy input/ output of aquaculture systems and horticulture systems • List and contrast the advantages and disadvantages of aquaponics vs. other methods of agriculture	AQ.01.03.02.a AQ.09.01.01.b. AQ.14.01.01.b. AQ.15.01.01.a. AQ.15.01.08.b. WHST.9-10.2a
Explore various methods and types of	• Research and evaluate the different types of modern aquaponics	AQ.09.01.02.a.

aquaponics systems	systems ● List advantages and disadvantages of each system ● Critique homemade aquaponics systems that are commonly sold online or marketed through social media ● Design, sketch and present an aquaponics system for a small aquarium	AQ.15.01.01.a. AQ.15.01.02.b AQ.15.01.05.b. SL.9-10.5
Identify the components of an aquaponics system and describe their role in filtration, water quality and organism growth.	● Identify and describe in writing the function of specific aquaculture and aquaponics equipment ● Describe a typical layout of an aquaponics system detailing the water movement, functions and filtration ● Compare and contrast methods of media, containers and plant grow beds used in aquaponics ● Design a video walkthrough of the greenhouse's aquaponics system detailing the filtration, nutrients, organisms and water flow	AQ.08.01.05.b. AQ.09.01.03.b. AQ.09.01.04.a. AQ.15.01.01.a. AQ.15.01.02.b AQ.15.01.04.c AQ.15.01.05.b. WHST.9-10.2a
Identify and compare plant species used in aquaponics systems	● Identify and compare common plants used in aquaponics ● Compare and contrast plant needs in aquaponics ● Determine the appropriate plants to use in specific types of aquaponics systems ● Review proper techniques to germinate, root, and grow plants in various types of media ● Diagnose plant deficiencies and suggest treatment	AQ.15.01.01.b. AQ.15.01.02.b. AQ.15.01.02.c. AQ.15.01.05.c. MP.3
Identify and compare animal species used in aquaponics systems	● Identify and compare common aquatic animal species used in aquaponics ● Compare and contrast organism needs in aquaponics ● Determine the appropriate aquatic animal species for use in a specific system ● Review fish health and care	AQ.15.01.01.b. AQ.15.01.04.c. MP.3

Unit 3	Water Testing and Analysis
Essential Questions	1. What are the suitable water parameters for a healthy aquaponics system? 2. How do you test and analyze the water in an aquaponics system? 3. What are some of the methods to remediate poor water quality?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and	AQ.09.01.04.a. Describe how the bio-filter of a recirculating aquaculture system (RAS) converts ammonia to nitrite, and nitrite to nitrate.

Natural Resources Standards	AQ.09.01.04.b. Diagram the nitrogen cycle in relation to aquaculture. AQ.09.03.01.b. Describe risks related to hazardous materials and describe health and safety practices to reduce risks from hazardous materials. AQ.14.03.01.c. Demonstrate proper technique for taking water samples to perform water quality assessments. AQ.14.03.02.b. Conduct a dissolved oxygen test. Analyze and record test results. AQ.14.03.03.b. Take, record and analyze water temperature measurements. AQ.14.03.04.b. Take, record and analyze pH measurements. AQ.14.03.07.b. Measure, record and analyze the following water quality factors as necessary: water hardness, carbon dioxide, salinity, iron, chlorine, and hydrogen sulfide. AQ.15.01.02.b. Describe favorable attributes for plant species used in aquaponics. AQ.15.01.03.b. Describe plant nutritional deficiencies.
Common Core State Standards	RST.9-10.4 Determine the meaning of words and phrases as they are used in text, including analyzing how an author uses and refines the meaning of a key term over the course of a text SL.9-10.5 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. MP3 Construct viable arguments and critique the reasoning of others.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.08.01.01.b. Analyze characteristics of water that influence the biosphere and sustain life. AQ.14.03.01.a. Identify water quality factors that are important in aquaculture systems. AQ.14.03.06.c. Analyze management practices that will reduce TAN in aquaculture systems.
Common Core State Standards	WHST.9-10.2a Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension MP1 Make sense of problems and persevere in solving them. MP2 Reason abstractly and quantitatively.

Objectives	Activities	CT AFNR, NGSS, CCSS

Outline, discuss the essential nutrients of aquaponics systems and their relation to plant growth	• Discuss the three essential nutrients in plant growth and their availability in aquatic systems • Discuss, graph and analyze the Nitrogen cycle and its role in aquaculture filtration and plant use • Create a chart displaying plant deficiencies and supplements	AQ.08.01.01.b. AQ.09.01.04.b. AQ.15.01.02.b AQ.15.01.03.b. WHST.9-10.2a
Test, analyze and adjust the essential nutrients (NPK) for plant growth in an aquaponics system.	• Safely perform necessary water tests to determine the nutrient levels in an aquaponics system • Create an ongoing record of water sampling and results using spreadsheets • Suggest and implement supplements for improved plant growth • Locate, read and interpret SDS for water testing reagents	AQ.08.01.01.b. AQ.09.01.04.a AQ.14.03.01.c. AQ.14.03.04.b. AQ.14.03.07.b. AQ.15.01.02.b. AQ.15.01.03.b. RST.9-10.4 WHST.9-10.2a SL.9-10.5 MP3
Test and track the water parameters of the nitrogen cycle	• Describe and diagram the Nitrogen cycle and its role in biological filtration and aquaponics • Test for all forms of Nitrogen (Ammonia, Nitrite and Nitrate), dissolved oxygen and pH in an aquaponics system. • Analyze water test results to conclude, in writing, biological filtration and cycling in a recirculating system • Provide recommendations for the improvement of water quality based on results • Discuss and evaluate different methods of biofiltration in aquaponics	AQ.05.01.01.a AQ.09.01.04.b. AQ.14.03.01.a. AQ.14.03.01.b. AQ.14.03.02.a. AQ.14.03.02.b. AQ.14.03.04.b. WHST.9-12.9 RST.9-10.4 MP1 MP2
Test and assess the water quality of an aquaponics system.	• Review water quality parameters and their effects on aquatic life • Discuss the control and monitoring of essential water parameters such as Ammonia, Dissolved Oxygen, and pH • Safely perform necessary water tests to determine the water quality in an aquaponics system • Create an ongoing log of water sampling and results using	AQ.08.01.01.b AQ.09.01.04.a AQ.09.01.04.b. AQ.14.03.01.a. AQ.14.03.02.b. AQ.14.03.03.b. AQ.14.03.04.b.

	spreadsheets ● Suggest and implement remediation based on results ● Locate, read and interpret SDS for water testing reagents	AQ.14.03.06.c. AQ.14.03.07.b. RST.9-10.4 SL.9-10.5 MP3

Unit 4	Aquaponics Design and Maintenance
Essential Questions	1. How can you integrate aquaponics into an aquaculture system? 2. What are the proper maintenance protocols for managing an aquaponics system?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.09.01.03.a. Identify and describe the following parts of a recirculating aquaculture system (RAS): tank, sump or reservoir, pump, solid waste filter, U/V sterilizer, heat exchanger, bio-filter, and aeration. AQ.09.01.03.b. Explain the basic electrical, plumbing and mechanical components of aquaculture systems. AQ.09.01.03.c. Construct a recirculating aquaculture system (RAS) based on dynamic interaction including flow rate, size, capacity, plumbing, friction loss, species and component requirements. AQ.09.01.04.c. Design and construct a functional bio filtration system. AQ.14.03.01.a. Identify water quality factors that are important in aquaculture systems. AQ.14.03.01.b. Describe the water quality factors most likely to be involved with aquaculture losses. AQ.15.01.02.b. Describe favorable attributes for plant species used in aquaponics. AQ.15.01.04.c. Choose aquatic animal species for use in an aquaponics system.

	AQ.15.01.05.c. Choose an aquaponics system based on aquatic animal and plant species to be grown. CS.08.01.01.c. Use tools and equipment appropriately to complete a specific task.
Common Core State Standards	WHST.9-10.1.e Provide a concluding statement or section that follows from or supports the argument presented. WHST 9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience MP 4 Model with mathematics MP 5 Use appropriate tools strategically

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.10.01.02.a. Repair and maintain vehicles, vessels, tools and equipment. AQ.14.03.08.b. Explain methods to control weeds and algae in aquaculture systems.
Common Core State Standards	RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics MP 5 Use appropriate tools strategically

Objectives	Activities	CT AFNR, NGSS, CCSS
Plan, design, construct a project that integrates aquaponics into an existing aquaculture system	• Plan and design an aquaponics system to integrate into an aquarium or recirculating system • Sketch a plan and a materials list for an aquaponics system. • Construct an aquaponics system based on a design plan • Use proper tools, materials and safety measures during construction • Record the planning, design, and construction of an aquaponics system in a journal • Select appropriate aquatic organisms and plants for the system • Summarize the aquaponics system upon completion • Present the aquaponics system to the class using a video or verbal presentation format	AQ.09.01.03.b. AQ.09.01.04.c. AQ.09.01.03.c. AQ.15.01.02.b AQ.15.01.04.c AQ.15.01.05.c. CS.08.01.01.c. WHST.9-10.4 WHST.9-10.1.e MP 4 MP 5
Analyze water parameters for the introduction of	• Cycle and track the water quality using water testing and	AQ.14.03.01.a.

plants and aquatic animals	analysis ● Acclimate and introduce production species to the aquaponics system ● Germinate and introduce appropriate plant species to the aquaponics system ● Monitor and maintain water quality of an aquaponics system ● Journalize water parameters to map trends in water quality and nutrients	AQ.14.03.01.b. AQ.15.01.04.c. AQ.15.01.05.c RST.9-10.4 WHST.9-10.1.e MP 5
Perform the necessary maintenance tasks on aquaponics systems	● Demonstrate appropriate maintenance and equipment use of an aquaponics system ● Demonstrate proper use, care and sanitation of aquaculture equipment ● Develop and implement a maintenance schedule for a specific aquaponics system ● Perform specific system checks based on aquaponics maintenance and requirements	AQ.09.01.03.a. AQ.09.01.03.b. AQ.10.01.02.a. AQ.14.03.08.b. CS.08.01.01.c.

Vocabulary:

Airlift	Coupling	Nitrosomonas
Ammonia	Cycling	Nitrospira
Binomial Nomenclature	Dissolved Oxygen	Production Tank
Biofilter	Filter Fiber	Poly Vinyl Chloride (PVC)
Bioreactor	Gasket	Recirculating System
Biofiltration	Gravity Fed	Settling Tank
Biomedia	Mechanical Filtration	Siphon

Bulkhead Fitting	Nitrate	Stand Pipe
Chemical Filtration	Nitrite	Submersible Pump
Clarifier	Nitrogen Cycle	Vortex Filter

Assessments:
Assignments
Quizzes
Practical Work Rubric
Water Analysis Assessments
Aquaponics Journal
Project Assessment
Aquaponics Presentation

Connections to College/Career Readiness:

Resources/Materials:
Aquatic Systems Engineering: Devices and How they Function
Reference: Aquaponics Production Manual - A Practical Handbook for Growers, Kentucky State University Land Grant Program
Reference: Aquaponics Food Production: Raising Fish and Plants for Food and Profit, Nelson and Pade
Reference: Aquaponic Gardening: A Step-By-Step Guide to Raising Vegetables and Fish Together, Bernstein
Reference: Aquatic Systems Engineering: Devices and How they Function, P.R. Escobal. DEP
Reference: Sustainable Aquaculture, Bardach
Text: Aquaculture Science, Second Edition. Parker. Delmar, 2002
SRAC (Southern Regional Aquaculture) Publications
Aquaponics Equipment and Materials: Plumbing Tools, PVC plumbing materials/adhesives, submersible pumps, aerators, tubing and air stones
Water Testing Safety Equipment and Kits
Access to recirculating systems and aquaponics equipment, systems and species

Course Title	Horticulture Business Practices
Agriculture Pathway	Plant Systems
Length of Course	One Quarter
Ledyard High School Vision of the Graduate	Demonstrate an ability to communicate information clearly and effectively through a variety of media, including written, oral, visual, musical, and/or video productions. Demonstrate critical thinking skills to find solutions, support arguments, and overcome challenges in a variety of content areas.
Course Overview	Students will have the opportunity to create business products including but not limited to arrangements for holidays such as Easter, Memorial Day, National Administrative Professionals Day, National Teacher Day, etc., garden decorations, perennial or

	annual plant sales and more. Students will use basic floriculture techniques, learn tools commonly used in the floral and nursery industry, learn woodworking and metal fabrication skills. Students will gain a basic understanding of business skills that can be utilized in all aspects of the Agri-Science program.
Units of Study	1. Business Practices 2. Project Design

Unit 1	Business Practices
Essential Questions	1. How are products marketed for sale? 2. What are the essential components of a business plan? 3. What are the qualifications of a business portfolio that make you marketable?

Priority Standards Assessed in Learning

Connecticut	PS.04.02.02.a. Research and summarize the principles and elements of design for use in plant systems.

Agriculture, Food, and Natural Resources Standards	ABS.01.02.02.a. Identify the meaning and importance of goals and objectives in AFNR business enterprises. CRP.10.04.01.a. Identify and explain the purpose of fundamental tools used to pursue a career path (e.g., resume, cover letter, portfolio, etc.) as well as the common components of each (e.g., content in cover letter, categories in resume, etc.). ABS.05.03.01.a. Identify and explain marketing principles used in AFNR businesses (e.g., 4 P's- product, place, price, promotion; attention, interest, desire, action, etc.).
Common Core State Standards	RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	ABS.02.01.01.a. Examine and describe accounting systems and procedures used for record keeping in AFNR businesses (e.g., cash vs. accrual systems, identification of appropriate accounts, double-entry accounting, entry of debits and credits, etc.). ABS.03.01.01.a. Compare and contrast components of cash budgets (e.g., anticipated revenue, production costs, overhead costs, profit, etc.) and identify the appropriate components to include in a budget given the nature of the AFNR enterprise. ABS.04.01.02.a. Categorize the characteristics of the types of ownership structures used in AFNR businesses (e.g., sole proprietorships, cooperatives, partnerships and corporations). CS.05.01.03.a. Research and summarize specific tools (e.g., resumes, portfolios, cover letters, etc.) and processes (e.g., interviews, applications, etc.) needed to pursue a career in an AFNR pathway.
Common Core State Standards	WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. SL.9-10-.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Learning Objectives	Activities	CT AFNR, NGSS, CCSS
Understand marketing principles.	• Create a mock product and implement the 4 P's of marketing. • Create a sales pitch to sell a product. • Create a survey and identify a target market for a specific product. • Create lists of items used in a business and find the overhead cost and cost of marketing. • Conduct a sales call to promote a product to a customer. • Develop SMART goals and objectives related to SAE, businesses	ABS.01.02.02.a. PS.04.02.02.a. CRP.10.04.01.a. ABS.02.01.01.a. ABS.05.03.01a ABS.03.0101.a. ABS.04.01.02.a. CS.05.01.03.a.

	and products. ● Compare and relate elements and principles of design in floral design to those used in advertisements. ● Identify the different ownerships in agricultural businesses. ● Sales call	RST.9-10.4. WHST.9-10.4.
Create materials to promote business practices.	● Create a resume and cover letter. ● Analyze different marketing advertising and understand what attracts the customers. ● Using principles and elements of design, develop an advertisement for a bulletin board, newspaper, article, social media, flier and/or radio. ● Identify different components as debits and credits, income and expenses, creating a mock account balance. ● Create job listings depicting the roles of each worker in a business. ● Conduct a “speed sales talk”	PS.04.02.02.a. ABS.05.03.01a ABS.03.0101.a. CS.05.01.03.a. RST.9-10.4. WHST.9-10.4. SL.9-10-.4

Unit 2	Project Design
Essential Questions	1. How do I create a desirable horticultural product or service in the industry? 2. How do I market a desirable horticultural product or service in the industry?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	PS.04.02.03.a. Identify and categorize tools used for design (e.g., computer landscape software, drawing tools, florist tools, etc.).
Common Core State Standards	RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. SL.9-10-.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	PST.02.02.02.b. Apply safety principles and applicable regulations to operate equipment, machinery and power units used in AFNR power, structural and technical systems.
Common Core State Standards	SL.9-10.5.Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

Objectives	Activities	CT AFNR, NGSS, CCSS
Develop a plan for a horticulturally related project	• Research products that can be created for a horticultural business. • Create a cost benefit analysis of the proposed project. • Present business and marketing plan to a group of peers. • Develop a Business Plan.	PS.04.02.03.a. PST.02.02.02.b. SL.9-10.5. WHST.9-10.2.
Execute a project plan in order to meet established goals	• Utilize equipment to create a product to be potentially sold. • Manage a marketing plan and inventory list to keep products selling.	PS.04.02.03.a. PST.02.02.02.b.

	• Create advertisements to sell a specific product • Present project plan to judges or potential investors • Meet with loan officers to discuss opening an agricultural business.	RST.9-10.3. SL.9-10.5. SL.9-10-.4

Vocabulary:

Balance
Business plan
Cost Benefit Analysis
Elements of Design
Focal Point
Loan
Marketing
Place
Price
Principles of Design
Product
Promotion
Repetition
Rhythm

Assessments:

Final Product Design
Quizzes
Mock sales pitch

Connections to College/Career Readiness:

Certificate in Personal Finance
Objectives of this course align with those in the UConn ECE Floral Art course that students can take for credit through Ag 3 and Ag 4 Plant System classes.

Resources/Materials:

National Ag Sales CDE
ICEV Center for Financial Responsibility Personal Financial Literacy Certification Strategies for Success
www.gardening.cornell.edu
Connecticut Nursery and Landscape Association https://www.cnla.biz/
Ornamental Horticulture, Ingels, Delmar
https://farmcredit.com/

https://www.bbb.org/
https://www.farmers.gov/
https://www.usda.gov/

Course Title	Sustainable Horticulture
Agriculture Pathway	Plant Systems
Length of Course	One Quarter
Ledyard High School Vision of the Graduate	Demonstrate an ability to communicate information clearly and effectively through a variety of media, including written, oral, visual, musical, and/or video productions. Demonstrate critical thinking skills to find solutions, support arguments, and overcome challenges in a variety of content areas.
Course Overview	This unit provides an introduction to sustainable horticulture; topics will include soil composition, soil horizons, amendments, fertilizers, composting, growing methods and conservation. Students will study their own soil and determine amendments to make based on their needs and growing materials. Students will study sustainable practices in farming and create and execute a plan for a system creation. This project can include development of a hydroponic system, aquaponic system, vertical garden, container gardening, etc.
Units of Study	1. What is Soil? 2. Growing Methods 3. Conservation and Sustainability

Unit 1	What is Soil?
Essential Questions	1. How is soil created? 2. How do you make soil healthy?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	ESS.05.02.02.b. Assess different measurements of soil quality (e.g., soil horizons, soil texture, organic matter, soil respiration, etc.) to determine their effectiveness and limitations. NRS.01.05.04.a. Compare and contrast techniques associated with soil management (e.g., soil survey and interpretation, erosion control, etc.).
Common Core State Standards	WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	CS.06.01.01.a. Research and explain the foundational cycles in AFNR (e.g., water cycle, nutrient cycle, carbon cycle, etc.). PS.01.02.03.b. Discuss how soil drainage and water-holding capacity can be improved.
Common Core State Standards	RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Learning Objectives	Activities	CT AFNR, NGSS, CCSS
Identify the different components of soil.	• Identify the different layers of the soil horizon. • Test soil samples for sand, silt and clay percentages and compare that to the national soil database. • Determine the soil texture class of a sample using the soil texture triangle. • Understand water cycles and nutrient cycles. • Read and interpret fertilizer labels. • Identify means of preventing and controlling erosion. • Understand Soil ecosystems and their importance. • Test soil samples for organisms	ESS.05.02.02.b. CS.06.01.01.a. PS.01.02.03.b. NRS.01.05.04.a. WHST.9-10.2. RST.9-10.3. RST.9-10.4.
Explain how to improve soil quality.	• Conduct N, P, K and pH testing on soils samples. • Compare various methods of improving soil quality: cover crops, minimum tillage, composting and organic amendments. • Create compost bins to be used in class. • Understand how compost bins decompose and create ideal amendments. • Identify the best decomposers used in compost.	PS.01.02.03.b. NRS.01.05.04.a. WHST.9-10.2. RST.9-10.3. RST.9-10.4.

Unit 2	Growing Methods
Essential Questions	1. Why do plants have different growing requirements? 2. How do you grow plants using different methods?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	PS.01.03.01.b. Explain the appearance of plants that have a deficiency of N, P, and/or K. PS.03.02.07.b. Compare and contrast the types of systems used in hydroponic and aquaponics plant production. PS.05.01.01.a. Describe characteristics of successful greenhouses and create a list of factors for planning and designing greenhouse facilities. Factors must include physical location, market potential, utilities, climatic conditions, and production goals. ESS.04.02.03.a. Research and summarize the benefits and processes of composting.
Common Core State Standards	WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.15.01.01.a. Define aquaponics. PS.01.01.03.a. Identify and summarize the effects of water quality on plant growth, (e.g., pH, dissolved solids, etc.). PS.05.02.01.a. Demonstrate effective methods to meet water requirements for healthy plant growth. Examine and explain how water pH influences plant growth. Research from multiple technical texts the function and operating principles of greenhouse irrigation systems (such as misting, drip, and overhead systems) to meet watering requirements for the purposes of maintaining optimum moisture level for a variety of plants. PS.05.01.01.b. Explain how greenhouses promote plant growth through light, air movement, temperature, and humidity control.
Common Core State Standards	SL.9-10-.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Objectives	Activities	CT AFNR, NGSS, CCSS
Identify the different methods for growing plants	• Classify the different systems for Hydroponics. • Identify the parts for aquaponics systems. • Create a hydroponics or aquaponic system. • Grow plants using a non-soil method. • Understand the growing requirements for plants and which ones can be used in soilless media. • Grow plants to be used in a plant sale. • Identify the deficiencies of nutrients that plants have. • Discuss the composting process. • Create a vermicomposting bin • Maintain a compost and compare to the vermicomposting process	PS.01.03.01.b. AQ.15.01.01.a. PS.03.02.07.ab PS.01.01.03.a. RST.9-10.4. WHST.9-10.4. ESS.04.02.03.a.
Evaluate different structures for growing plants	• Identify and label the parts of a greenhouse. • Identify the different greenhouse structures. • Create a 3-D model of a greenhouse. • Identify the pros and cons of different structures.	PS.05.01.01.a. PS.05.02.01.a. RST.9-10.4. SL.9-10-.4 RST.9-10.3. PS.05.01.01.b.

Unit 3	Conservation and Sustainability
Essential Questions	1. How can an individual be a steward of the land? 2. How can an individual become a sustainable agriculturalist?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CS.04.01.02.a. Read and interpret the definition of sustainability and summarize how it relates to AFNR activities. PS.03.04.01.a. Compare and contrast the alignment of different production systems (conventional and organic) with USDA sustainable practices criteria. CS.04.01.01.b. Analyze available practices to steward natural resources in AFNR systems (e.g., wildlife and land conservation, soil and water practices, etc.).
Common Core State Standards	RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.15.01.08.b. Discuss how aquaponics is sustainable. NRS.02.05.03.a. Examine and describe how communication can be used to influence behavior, call people to action and instill a sense of civic behavior related to the conservation, management, enhancement and improvement of natural resources.
Common Core State Standards	WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research.

Objectives	Activities	CT AFNR, NGSS, CCSS
Determine how someone can help promote conservation	• Determine the difference between conservation and preservation. • Identify different conservation methods to be used in agriculture. • Understand the history of conservation law. • Identify the characteristics of Urban Soil. • SDescribe ways of dealing with Urban soil. • Identify different methods of growing plants in an urban setting.	CS.04.01.02.a. PS.03.04.01.a. AQ.15 NRS.02.05.03.a. CS.04.01.01.b. RST.9-10.4. WHST.9-10.4. WHST.9-12.9

Vocabulary:

Abiotic
Amendments
Aquaponics
Bedrock
Biotic
Clay
Composting
Conservation
Decomposers
Greenhouse
Humus
Hydroponics
Mineral Matter
Organic Matter
Parent Material
Regenerative Agriculture
Sand
Silt
Soil Horizons
Soilless Media
Steward
Sustainable Agriculture
Top soil
Vermicomposting
Vermiculture
Weathering

Assessments:

What is Soil? Quiz
Unit test
Greenhouse structure assessment
Sustainability project

Connections to College/Career Readiness:
Objectives of this course align with those in the UConn ECE Fundamentals of Horticulture course that students can take for credit through Ag 3 and Ag 4 Plant System classes.

Resources/Materials:
Text: Soil Science and Management by Edward J. Plaster
Soil
Composting materials
Vermicomposting materials
Plants for vegetable spring sale
ICEV resources
Understanding Ag 'Growing Soil' Through Adaptive Grazing

Course Title	Biotechnology
Agriculture Pathway	Plant Systems & Animal Systems
Length of Course	One Quarter
Ledyard High School Vision of the Graduate	Demonstrate critical thinking skills to find solutions, support arguments, and overcome challenges in a variety of content areas. Demonstrate an ability to work effectively with others, sharing ideas, acknowledging one another's strengths, and collaborating to produce presentations, projects, performances, or events.
Course Overview	In this course students will define biotechnology, research and present on various examples of biotechnology. The history of biotechnology will be traced and discussed. Topics include, but are not limited to: cloning, fermentation, tissue culture, and transgenic plants and animals. The impact of biotechnology on the agricultural industry will be examined.
Units of Study	1. What is biotechnology? 2. Introduction to DNA 3. Methods of biotechnology

Unit 1	What is biotechnology?
Essential Questions	1. How did biotechnology evolve over time? 2. Why is biotechnology important? How is biotechnology used to enhance the agriculture industry? 3. How do you address ethical dilemmas as they relate to biotechnology?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	BS.01.01.01.a. Research and summarize the evolution of biotechnology in agriculture. BS.03.01.01.a. Summarize biological, social, agronomic and economic reasons for genetic modification of eukaryotes. BS.01.03.03.a. Research and summarize public perceptions of biotechnology in agriculture (e.g., social and cultural issues). BS.01.03.01.a. Research and summarize the emergence, evolution and implications of bioethics associated with biotechnology in agriculture.
Common Core State Standards	WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research. RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	BS.02.03.02.a. Examine and implement standard operating procedures for the use of biological materials according to directions and their classification (e.g., proper handling of bacteria or DNA before, during and after use). BS.02.04.01.a. Classify different types of personal protective equipment and demonstrate how to properly utilize the equipment.

Common Core State Standards	WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Learning Objectives	Activities	CT AFNR, NGSS, CCSS
Define biotechnology and its history	● Create a timeline of major contributions in the history of biotechnology. ● Research common techniques used in biotechnology.	BS.01.01.01.a. WHST.9-10.9 WHST.9-10.4.
Explain the importance of biotechnology	● Research the public perception of biotechnology and create short videos of findings. ● Create informative fliers on biotechnology in use. ● Create video channels explaining methods of biotechnology, their purpose, importance and benefits. ● Assess the risks of biotechnology and compare the benefits. ● Identify equipment used in biotechnology. ● Understand the importance of PPE while using equipment.	BS.01.03.03.a BS.02.03.02.a. BS.02.04.01.a WHST.9-10.9 RST.9-10.4. WHST.9-10.4.
Identify the ethical issues related to biotechnology	● Discuss ethical concerns in biotechnology. ● Analyze a current ethical situation in biotechnology and propose a solution. ● Participate in debate over the methods and ethical reasoning for or against biotechnology topics. ● Identify methods of genetic engineering that are labeled as organic.	BS.03.01.01.a. BS.01.03.01.a. WHST.9-10.9 RST.9-10.4.

Unit 2	Introduction to DNA
Essential Questions	1. How is DNA used in Biotechnology? 2. Why is DNA important?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	BS.02.05.02.a. Compare and contrast the structures of DNA and RNA and investigate how genotype influences phenotype. BS.02.05.03.a. Extract and purify DNA and RNA according to standard operating procedures.
Next Generation Science Standards	HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
Common Core State Standards	WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	BS.02.04.01.a. Classify different types of personal protective equipment and demonstrate how to properly utilize the equipment.
Common Core State Standards	RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Objectives	Activities	CT AFNR, NGSS, CCSS
Distinguish between prokaryotic and eukaryotic cells.	• Identify how genotype affects phenotypes through crossover DNA lab. • Study stem cell research and the purpose and importance of them. • Extract DNA from a variety of fruits. • Understand the use of electrophoresis and the purpose it has.	BS.02.05.02.a. BS.02.04.01.a. HS-LS1-1. WHST.9-10.9 RST.9-10.4.
Describe the structure of chromosomes and DNA	• Compare and contrast Genotype and Phenotype. • Apply knowledge of the structure of DNA to gene expression. • Demonstrate how to extract DNA from living organisms. • Determine the ethical and	BS.02.05.02.a. BS.02.05.03.a. BS.02.04.01.a. HS-LS1-1. WHST.9-10.9 RST.9-10.4.

Unit 3	Methods of biotechnology
Essential Questions	1. Why is genetic engineering playing an important role in our society? 2. How do you complete the process of genetic engineering?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	BS.01.01.03.a. Distinguish between current and emerging applications of biotechnology in agriculture. BS.01.01.04.a. Compare and contrast the benefits and risks of biotechnology compared with alternative approaches to improving agriculture.
Next Generation Science Standards	HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
Common Core State Standards	WHST.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	BS.01.03.02.a. Research and summarize legal issues related to biotechnology in agriculture (e.g., protection of intellectual property through patents, copyright, trademarks, etc.). BS.03.01.01.a. Summarize biological, social, agronomic and economic reasons for genetic modification of eukaryotes. BS.02.02.01.a. Identify, interpret, and implement standard operating procedures for laboratory equipment.

Next Generation Science Standards	HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
Common Core State Standards	RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. SL.9-10-.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Objectives	Activities	CT AFNR, NGSS, CCSS
Research Biotechnology practices/methods significant to a chosen agriculture industry	• Discuss biotechnology practices/methods significant to a chosen agriculture industry. • Explore the process of electrophoresis and the role it plays in biotechnology • Apply knowledge of electrophoresis to setting up laboratory equipment in the classroom. • Research emerging practices in biotechnology.	BS.01.01.03.a. BS.02.02.01.a. WHST.9-10.7 WHST.9-10.9 RST.9-10.4. SL.9-10-.4
Explain the benefits and risks of biotechnology compared to other methods.	• Research the process of repurposing property previously used for biotechnology. • Identify the benefits and risks of biotechnology related to a chosen agriculture industry. • Create a presentation showing pros and cons of biotechnology.	BS.01.01.04.a. BS.01.03.02.a. BS.03.01.01.a. WHST.9-10.9 SL.9-10-.4
Examine the techniques of Genetic Engineering	• Demonstrate knowledge of mitosis and meiosis through labs. • Distinguish between the following GE techniques: breeding, mutagenesis, polyploidy, transgenesis, and gene editing. • Look at different organisms that have been genetically modified and classify them as a breeding, mutagenesis, polyploidy, transgenesis, or gene editing method. • Students will research cloning, fermentation, tissue culture, and transgenic plants and animals • Discuss the use of glyphosate in plants.	BS.03.01.01.a. BS.02.02.01.a. HS-LS1-4. HS-LS3-2. WHST.9-10.7 RST.9-10.4. SL.9-10-.4

Vocabulary:

Bioengineered
Biotechnology
Breeding
Cloning
DNA
Electrophoresis
Fermentation
Gene Editing
Genetic engineering
Genetically Modified Organism
glyphosate
Meiosis
Mitosis
Mutagenesis
Polyploidy
RNA
Stem cells
Tissue Culture
Transgenesis
Transgenic

Assessments:

Quizzes
Unit test
Electrophoresis project
Genetic Engineering technique project
Biotechnology debate
Biotechnology timeline

Connections to College/Career Readiness:

https://agexplorer.ffa.org/focus/biotechnology-systems
Objectives of this course align with those in the UConn ECE Fundamentals of Horticulture course that students can take for credit through Ag 3 and Ag 4 Plant System classes.

Resources/Materials:

Introduction to Biotechnology - William J. Thieman, Michael A Palladino
Genetics, Agriculture, and Biotechnology - Walter Suza
https://www.isaaa.org/resources/publications/agricultural_biotechnology/download/agricultural_biotechnology.pdf
https://www.usda.gov/topics/biotechnology/biotechnology-frequently-asked-questions-faqs
Microscope, Microscope slides
Gel electrophoresis kit and machine
Pipettes, Insemination catalogs
Chromebooks
Test tubes
Experimental enzymes

GM seeds

Course Title	Introduction to Landscaping
Agriculture Pathway	Plant Systems
Length of Course	One Quarter
Ledyard High School Vision of the Graduate	Demonstrate creativity through their participation in fine arts courses as well as through their inventive approaches to learning activities in a variety of settings. Demonstrate an ability to communicate information clearly and effectively through a variety of media, including written, oral, visual, musical, and/or video productions.
Course Overview	This is an introduction to landscape design. Students will learn about common plants used in the industry, how to use and maintain equipment and create a basic landscape and maintenance chart. Students will look at utilizing CT native plants as a replacement for popular landscape industry plants. Students will create a landscape and implement their designs to surrounding gardens.
Units of Study	1. Landscape Design 2. Landscape Equipment 3. Landscape Maintenance and Development

Unit 1	Landscape Design
Essential Questions	1. How is a landscape designed? 2. Why are specific plants used in a design?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	PS.04.01.01.a. Identify and categorize plants by their purpose (e.g., floral plants, landscape plants, house plants, etc.). PS.04.02.02.a. Research and summarize the principles and elements of design for use in plant systems. NRS.04.03.02.a. Identify and classify invasive species common to a particular region.
Common Core State Standards	WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. SL.9-10-.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	PS.04.02.03.a. Identify and categorize tools used for design (e.g., computer landscape software, drawing tools, florist tools, etc.). PS.04.01.02.a. Summarize the applications of design in agriculture and ornamental plant systems. PS.03.03.01.a. Identify and categorize plant pests, diseases and disorders.
Common Core State Standards	WHST.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. SL.9-10.5.Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations

	to enhance understanding of findings, reasoning, and evidence and to add interest.

Learning Objectives	Activities	CT AFNR, NGSS, CCSS
Categorize plants and their purpose in a landscape	● Identify native and ornamental plants used in the landscape industry. ● Create a presentation identifying common plants used in the industry and appropriate native alternatives to them. ● Create a reference guide identifying plant information; sun requirements, water requirements, hardiness zone, soil preferences, pH level, pest management information.	PS.04.01.01.a. NRS.04.03.02.a. PS.04.01.02.a. PS.03.03.01.a. WHST.9-10.4. SL.9-10-.4 WHST.9-10.7 SL.9-10.5.
Identify components that go into a landscape design	● Create a landscape design using a CAD program. ● Identify the principles and elements of design to create a landscape. ● Apply landscape design principles to a unique perennial garden plan. ● Identify different IPM plans to present to potential customers.	PS.04.02.02.a. PS.04.01.02.a. PS.03.03.01.a. WHST.9-10.4. SL.9-10-.4 WHST.9-10.7 SL.9-10.5.

Unit 2	Landscape Equipment
Essential Questions	1. Why are certain pieces of equipment used during landscaping? 2. How do you maintain landscape equipment?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	PS.06.01.01.a. Select and safely use the following hand tools and equipment in the landscape industry: garden rake, leaf rake, shovel, spade, hand shears, loppers, rotary spreader, and drop spreader. PS.08.03.01.a. Explain the following in terms of selecting types of turf grass; growth habit and zone of growth.
Common Core State Standards	WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	PS.10.03.01.a. Explain the need to mow, aerate and thatch control lawns. PS.10.01.01.a. Identify irrigation methods for lawns.
Common Core State Standards	RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. SL.9-10-.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Objectives	Activities	CT AFNR, NGSS, CCSS
Operate equipment commonly used in the industry safely.	• Identify common equipment used in the industry. • Maintain a landscape that is free of safety hazards. • Demonstrate how to safely operate equipment used in the landscape industry. • Clean, sharpen, and lubricate hand tools. • Research common tools used in the landscape industry and identify their use.	PS.06.01.01.a. PS.09.01.01.a. WHST.9-10.4. RST.9-10.3. RST.9-10.4. SL.9-10-.4
Identify maintenance needed in lawn care.	• Clean and perform routine maintenance tasks to prepare landscape equipment for the season or for storage. • Identify the steps in a preventive maintenance schedule for equipment based on manufacturers recommendations and good practice. • Create a maintenance chart needed for equipment use in a landscape. • Identify different irrigation methods and the equipment for installation.	PS.06.01.01.a. PS.08.03.01.a. PS.10.03.01.a. PS.10.01.01.a. WHST.9-10.4. RST.9-10.3. RST.9-10.4. SL.9-10-.4

Unit 3	Landscape Maintenance and Development
Essential Questions	1. How is a landscape maintained throughout the year? 2. How is a landscape created?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	PS.04.02.02.b. Apply principles and elements of design that form the basis of artistic impression. PS.04.01.01.b. Demonstrate proper use of plants in their environment (e.g., focal and filler plants in floriculture, heat tolerant and shade plants in a landscape design, etc.).
Common Core State Standards	RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	PS.04.01.02.b. Create a design utilizing plants in their proper environments. PS.08.01.01.a. List the benefits that turf provides individuals and the environment. PS.09.01.01.a. Make a list of steps in order to prepare a site for establishing a lawn.
Common Core State Standards	WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. SL.9-10-.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Objectives	Activities	CT AFNR, NGSS, CCSS
Identify the care needed for plant goods in a landscape design.	• Develop a plan for fertilizing, mowing and irrigating lawns, turf, and golf courses. • Fertilize plants in the greenhouse and in established gardens. • Create a schedule for plant care, maintenance, fertilizing, re-seeding, etc. • Research the turf industry and care needed for turf fields. • Identify how to prepare a lawn for seeding.	PS.04.01.01.b. PS.08.01.01.a. PS.09.01.01.a. RST.9-10.4. WHST.9-10.4. SL.9-10-.4
Implement a landscape design.	• Utilizing principles and elements of design, implement a design into a landscape. • Using a plant information guide, create a three or four season design for a CT landscape.	PS.04.02.02.b. PS.04.01.01.b. PS.04.01.02.b. RST.9-10.4. WHST.9-10.4. SL.9-10-.4 RST.9-10.3.

Vocabulary:

Annual
Biennial
CAD Program
Cool season
Elements of Design
Exotic Plant
Hardscape
Invasive
Irrigation
Lawn mower
Native Plant
Perennial
Principles of Design
Rake
Shovel
Spade
String Trimmer
Trowel
Warm season

Assessments:

Identification quizzes

Design Projects
Landscape Problem assignments
Garden plan designs
Written quizzes and tests
Projects

Connections to College/Career Readiness:
Objectives in this course will prepare students for the Landscaping Course in Ag 3 and Ag 4.
https://agexplorer.ffa.org/focus/plant-systems

Resources/Materials:
Print and on-line plant catalogs
Landscape design tools: French curves, landscape templates, engineer's scales, compasses
www.ladybug.uconn.edu
www.gardening.cornell.edu
Connecticut Nursery and Landscape Association https://www.cnla.biz/
Ornamental Horticulture, Ingels, Delmar
OSHA Landscape Hazards and Solutions materials found at https://www.osha.gov/SLTC/landscaping/hazards.html
Pruning Techniques; Brooklyn Botanic Garden Record. Cook. Sterling Pub (Brooklyn Botanical Garden)
Turfgrass extension information found at http://plantscience.psu.edu/research/centers/turf/extension
Working in Horticulture. Richardson and Moore. McGraw-Hill, 1980

Course Title	Natural Resources Products
Agriculture Pathway	Plant Systems
Length of Course	One Quarter
Ledyard High School Vision of the Graduate	Demonstrate creativity through their participation in fine arts courses as well as through their inventive approaches to learning activities in a variety of settings. Demonstrate an ability to communicate information clearly and effectively through a variety of media, including written, oral, visual, musical, and/or video productions.
Course Overview	Students will have an opportunity to learn about Natural Resource products such as honey, lumber, maple syrup, hunting, fishing and sustainable energy sources. Students will learn to harvest and produce many products during this class. Students will have an opportunity to create solar energy products, boil sap, prepare a hive for honey collection, explore trees and their products and learn about hunting and fishing regulations with the potential to receive licensing. This course will prepare students to explore a career in the field of environmental science and natural resources.
Units of Study	1. Sugaring 2. Hunting and Gathering 3. Sustainable Energy Sources

Unit 1	Sugaring
Essential Questions	1. How is sap processed into syrup? 2. Why is monitoring the boiling process important?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	NRS.03.02.03.a. Identify different methods of collecting sap from trees, (buckets, plastic tubing, and plastic tubing with vacuum pumps.) NRS.03.02.04.a. Explain the process of boiling sap into syrup and syrup into sugar including using reverse osmosis process. NRS.03.02.07.b. Determine brix using a sap refractometer or sap hydrometer and calculate sap to syrup ratio using Jones' Rule of 86.
Common Core State Standards	RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	NRS.03.02.01.a. Explain how to identify sugar maple trees by buds, bark and silhouette. NRS.03.02.03.b. Identify equipment and supplies used in the production of maple syrup. NRS.03.02.05.a. Identify grades of maple syrup.
Common Core State Standards	WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Learning Objectives	Activities	CT AFNR, NGSS, CCSS
Identify common equipment used in the sugaring process.	● Identify the different collection methods for sap collection. ● Visit sugaring farms to see the process of sap collection. ● Utilize tree identification to recognize trees for sap collection. ● Create and set up a system for sap collection.	NRS.03.02.03.a. NRS.03.02.01.a. NRS.03.02.03.b.
Execute a method of boiling to create maple syrup.	● Using a refractometer or a sap hydrometer, identify the grade of maple syrup ● Examine the ways sap can be boiled into sugar. ● Make maple syrup through the boiling of sugar.	NRS.03.02.04.a. NRS.03.02.07.b. NRS.03.02.05.a.

Unit 2	Hunting and Gathering
Essential Questions	1. How do you safely collect natural resource products? 2. How do collection methods impact the quality of a product?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	AS.09.01.07.b. Demonstrate the use of tools and equipment used in beekeeping. NRS.01.05.03.a. Compare and contrast techniques associated with sustainable forestry (e.g., timber stand improvement, diversity improvement, reforestation, etc.). NRS.03.01.02.a. Research and describe methods by which wildlife can be sustainably harvested (e.g., controlled harvests, hunting licenses, regulations, etc.).
Common Core State Standards	RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AS.09.01.04.a. Identify types of honeybee housing. NRS.03.01.01.a. Summarize forest harvesting methods.
Common Core State Standards	WHST.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Objectives	Activities	CT AFNR, NGSS, CCSS
Identify safe forestry practices to collect products.	• Identify different trees as forestry products. • Utilize nature trails to further expand forestry identification. • Identify safety methods for shaping lumber. • Understand chainsaw safety. • Watch the process of “tree to board” at a local saw mill.	NRS.01.05.03.a. NRS.03.01.01.a. WHST.9-10.7. WHST.9-10.4. RST.9-10.3.
Explain an apiaries method of product collection.	• Identify different tools used in honey bee keeping. • Identify different hives available for use. • Set up a hive to be used throughout the year. • Identify common pests and diseases that affect honey production. • Learn how to winterize a beehive. • Learn the “spring cleaning” of honey bees. • Work with UConn to explore the basics of beekeeping with information from their Bee School.	AS.09.01.07.b. AS.09.01.04.a. WHST.9-10.7. WHST.9-10.4. RST.9-10.3.
Demonstrate how to properly harvest animal products as a natural resource.	• Review current year fishing and hunting regulations. • Identify the tools needed for fishing. • Make fly ties for specific fish in a specified season. • Learn about seasonal hunting and the legal requirements for harvesting wildlife (ie. deer, turkey, etc.). • Practice catch and release utilizing fishing rods and fly fishing rods. • Acquire fishing licensing, boating licensing and other applicable natural resource licenses	NRS.03.01.02.a. WHST.9-10.7 WHST.9-10.4. RST.9-10.3.

Unit 3	Sustainable Energy Sources
Essential Questions	1. How are natural resources utilized to create energy? 2. Why are sustainable energy resources being promoted?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CS.04.01.02.b. Analyze and assess sustainability practices that can be applied in AFNR systems (e.g., energy efficiency, recycle/reuse/repurpose, green resources, etc.). NRS.03.01.06.a. Compare and contrast the costs and benefits (e.g., environmental impacts, etc.) of alternative sources of energy (e.g., hydroelectric, solar, wind, biofuels, geothermal, etc.). NRS.02.04.03.a. Compare and contrast the economic impact of green technology and alternative energy.
Common Core State Standards	WHST.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. SL.9-10-.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	ESS.04.04.01.a. Research conventional energy sources and list conservation measures to reduce the impact on environmental service systems. ESS.04.04.02.b. Identify advantages and disadvantages of alternative energy sources as they pertain to environmental service systems. NRS.02.02.04.b. Identify solutions to improve the sustainability of modern lifestyles.
Common Core State	WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

Standards	WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. MP.4. Model with mathematics.

Objectives	Activities	CT AFNR, NGSS, CCSS
Research the costs and benefits of alternative energy sources vs conventional energy sources.	• Convert different energy sources to a common measurement (ie. BTU) and determine which energy source is more efficient. • Research a type of energy, provide details such as: cost, materials, energy obtained, etc. and present findings. • Create graphic images to compare and contrast cost	NRS.03.01.06.a. ESS.04.04.02.b. ESS.04.04.01.a. NRS.02.04.03.a. WHST.9-10.9 MP.4. SL.9-10-.4
Identify different methods of sustainable energy sources.	• Visit different energy farms to learn of the process of energy collection. • Create an energy source to complete a task. • Present findings of energy experiments and conduct a group discussion on efficiency.	CS.04.01.02.b. ESS.04.04.02.b. NRS.02.02.04.b. WHST.9-10.7 SL.9-10-.4 WHST.9-10.4.

Vocabulary:

Apiary
Bee Hive
Biofuel
Board foot
Foraging
Geothermal
Grading
Hydroelectric
Hydrometer
Langstroth hive
Lumber
Mushrooms
Refractometer
Sap
Solar
Sugar
Sugaring
Top Bar hive
USDA
Warre hive

Assessments:
Quizzes
Tests
Lab reports
Projects
Authentic experience reflections

Connections to College/Career Readiness:
Objectives in this course will prepare students for the Natural Resource Management Course in Ag 3 and Ag 4.
https://agexplorer.ffa.org/focus/natural-resources-systems
https://agexplorer.ffa.org/focus/environmental-service-systems

Resources/Materials:
Natural Resources System, Travis park and Tara Berescik
Beehive and tools
Sugaring tools
Field trips to local businesses
https://extension.okstate.edu/fact-sheets/true-cost-of-energy-comparisons-apples-to-apples.html

Course Title	Agricultural Maintenance: Electrical and Plumbing
Agriculture Pathway	Power, Structural and Technical Systems
Length of Course	One Quarter
Ledyard High School Vision of the Graduate	Demonstrate an ability to solve problems of varying complexity across content areas. Demonstrate critical thinking skills to find solutions, support arguments, and overcome challenges in a variety of content areas.
Course Overview	Agricultural Maintenance is an introduction to the basics of maintaining electrical and plumbing systems typical of agricultural and residential structures. An emphasis is placed on safety and following code in electrical and plumbing installations.
Units of Study	1. Electrical Theory and Practice 2. Plumbing Theory and Practice

Unit 1	Electrical Theory and Practice
Essential Questions	1. How do I troubleshoot electrical systems? 2. How do I design and construct electrical systems?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CS.03.04.01.a. Identify and differentiate the appropriate protective equipment for the safe use and operation of specific tools and equipment (e.g. PPE, etc.). CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment. PST.02.02.02.b. Apply safety principles and applicable regulations to operate equipment, machinery and power units used in AFNR power, structural and technical systems. PST.03.02.01.a. Compare and contrast basic units of electricity (e.g., volts, amps, watts, and ohms) and the principles that describe their relationship (e.g., Ohm's Law, Power Law, etc.). PST.03.02.01.b. Assess the tools used to measure the basic units of electrical circuits in AFNR power, structural and technical systems, and perform the measurements. PST.03.02.01.c. Analyze and design electrical circuits for AFNR power, structural and technical systems using knowledge of the basic units of electricity. PST.03.02.02.a. Compare and contrast the characteristics of electronic components used in AFNR power, structural and technical systems (e.g., battery, resistor, diode, transistor, capacitor, etc.) PST.03.02.02.b. Analyze and interpret electrical system symbols and diagrams. PST.03.02.02.c. Conduct testing procedures to evaluate and repair malfunctioning electrical components and systems used in AFNR power, structural and technical systems. PST.03.02.03.a. Classify the uses of electrical sensors and controls in AFNR power, structural and technical systems. PST.03.02.03.b. Distinguish and select materials and tools used in electrical control circuit installation. PST.03.02.03.c. Plan and install electrical control circuits and/or circuit boards to assure proper operation within AFNR power, structural and technical systems. PST.04.04.01.a. Define and measure amps, volts, and watts. PST.04.04.01.c. Install the following electrical circuits: duplex receptacle, single pole switch with light, and three-way switch with light. PST.04.04.02.a. Distinguish electrical circuits and the components of each. PST.04.04.02.b. Calculate the cost of operating an electrical motor. PST.04.04.02.c. Plan and wire electrical circuits (i.e., single pole switch, three-way switch, duplex outlet, etc.).

Common Core State Standards	RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. MP 2 Reason abstractly and quantitatively. MP 4 Model with mathematics.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.09.01.03.c. Construct a recirculating aquaculture system (RAS) based on dynamic interaction including flow rate, size, capacity, plumbing, friction loss, species and component requirements. PST.02.02.02.a. Examine and identify safety hazards associated with equipment, machinery and power units used in AFNR power, structural, and technical systems (e.g., caution, warning, danger, etc.).
Next Generation Science Standards	HS-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
Common Core State Standards	SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. WHST.9-10.2 - Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. WHST.9-10.7 - Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. WHST.9-10.8 - Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. WHST.9-10.9 - Draw evidence from informational texts to support analysis, reflection, and research.

Objectives	Activities	CT AFNR, NGSS, CCSS
Work safely and efficiently in an agricultural shop environment.	• Maintain a clean and safe shop environment. • Demonstrate procedures for maintaining a safe shop such as cleaning equipment and surroundings as well as determining and eliminating potential workplace hazards. • Describe the kinds of injuries that can occur from contact with electrical wires and from non-electrical hazards of electrical circuits. • Disconnect and lock-out electrical circuits in • preparation for service. • Read a scenario of an electrical accident and write a paragraph describing the factors that contributed to the accident and preventive measures that should be put in place to prevent recurrences.	CS.03.04.01.a. CS.03.04.01.b. PST.02.02.02.a. PST.02.02.02.b. PST.03.02.01.a. PST.03.02.01.b. PST.04.04.02.a. RST.9-10.3 RST.9-10.4 SL.9-10.4
Select hand tools appropriate to a given task.	• Use lineman's pliers, diagonal cutters and wire strippers to cut and prepare wire for installation. • Use a soldering iron to solder wire. • Use crimpers to secure bullet and spade connectors.	CS.03.04.01.a. CS.03.04.01.b. PST.02.02.02.b. PST.03.02.01.b. PST.03.02.03.b. PST.03.02.03.c. PST.04.04.02.c. RST.9-10.3 RST.9-10.4
Compare and contrast AC and DC electrical current.	• Study the characteristics of AC, DC and Electrical Signals. Sketch the voltage-time curve of DC and AC current. • Identify sources of AC and DC current. • Construct a chemical galvanic cell such as a Potato Battery or Lemon Battery and measure its voltage output. • Use a battery of galvanic cells to power a small device such as an LED, electronic watch or calculator. Measure voltage and current in the circuit.	PST.02.02.02.b. PST.03.02.01.a. PST.03.02.01.b. PST.04.04.02.a. RST.9-10.3 RST.9-10.4 MP 2
Describe the characteristics of electrical conductors, semiconductors and insulators	• Use a multimeter or continuity tester to classify substances as conductors, semiconductors or insulators. • Use a RESISTOR COLOR CODE GUIDE to determine the value of manufactured resistors. Compare the measured value to	PST.03.02.01.a. PST.03.02.01.b. PST.03.02.02.a. RST.9-10.3

	the marked value. ● Use an ohmmeter or multimeter to measure and compare the resistance of different materials.(Resistance is Futile)	RST.9-10.4 SL.9-10.4 WHST.9-10.2 MP 2
Use Ohm's and Kirchhoff's laws to analyze electrical circuits.	● Use Ohm's law to calculate voltage, current or resistance in simple electrical circuits. ● Analyze series, parallel and series-parallel networks of sources, conductors and resistors using Ohm's and Kirchhoff's laws.	PST.03.02.01.a. PST.03.02.01.b. PST.03.02.01.c. PST.03.02.02.a. PST.04.04.01.a. RST.9-10.3 RST.9-10.4 MP 2 MP 4
Measure voltage, current and resistance using a multi-meter.	● Use a multimeter to measure the voltage from dry cells, storage batteries and AC sources. ● Use a multimeter to measure the current in low-voltage DC circuits with known loads (resistors) and unknown loads such as LED's, lights and small motors. ● Use a multimeter to measure the resistance of varying lengths of materials such as a graphite pencil line or steel wire.	CS.03.04.01.a. CS.03.04.01.b. PST.02.02.02.b. PST.03.02.01.a. PST.03.02.01.b. PST.03.02.02.a. PST.03.02.02.c. PST.04.04.01.a. RST.9-10.3 RST.9-10.4 WHST.9-10.7 MP 2 MP 4
Perform calculations of electrical power and work.	● Measure voltage and current in an electrical circuit and calculate power consumption of the circuit. ● Measure voltage at the end of an extension cord to determine the power losses in the cord for a given application. ● Read a power meter and calculate power consumption. (How to Read Residential Electric and Natural Gas Meters | Department of Energy) ● Interpret information provided in an electric bill (Understanding Your Electric Bill | Eversource) to project electricity costs. ● Interpret information on the power consumption of different	PST.02.02.02.b. PST.03.02.01.a. PST.03.02.01.b. PST.03.02.02.a. PST.03.02.02.c. PST.04.04.02.b. PST.04.04.01.a. RST.9-10.3 RST.9-10.4 WHST.9-10.7 WHST.9-10.8

	types of lighting and billing rates to project savings from changing to a more efficient form of lighting. • Write an argumentative paragraph using data to justify a choice between two options – LED versus incandescent lighting, 12 gauge versus 16 gauge, etc.	MP 2 MP 4
Interpret circuit diagrams composed of current sources, conductors, loads and controls	• Identify the schematic diagram of common circuit components. Electrical Symbols and Line Diagrams, Circuit Schematic Symbols • Draw schematic diagrams of simple electric circuits. • Determine the function of an electrical circuit shown in a schematic diagram. • Model and Simulate a simple circuit based on a circuit diagram using simulation tools such as Tinkercad. • Construct a simple low voltage circuit, test its functionality and measure voltage and current at test points.	PST.03.02.01.c. PST.03.02.02.a. PST.03.02.02.b. PST.03.02.03.c. PST.04.04.02.a. RST.9-10.4 WHST.9-10.8
Wire common electrical supply and lighting circuits according to code.	• Identify and describe the function of SPST, DPST switches and dimmers in lighting circuits. (Light Switch Wiring Diagram) • Identify the meaning of wire color codes and cable markings used in AC and DC wiring. • Identify the meaning of screw color codes on controls, outlets and sockets used in AC wiring. • Write a paragraph comparing and contrasting the results of circuit faults in circuits with and without proper grounding protection. • Wire SPST and 3-way lighting circuits with current entering at different points in the circuit (at the switch, at the light, etc… Wire-3-way-switches) • Design and wire a circuit that will achieve a stated objective such as alternating power between two lights or making a light blink bright and dim. • Use a multimeter or continuity checker to analyze circuit function for proper operation or wiring errors in preparation for applying power.	CS.03.04.01.a. CS.03.04.01.b. PST.03.02.01.c. PST.03.02.02.a. PST.03.02.02.b. PST.03.02.03.c. PST.04.04.02.a. RST.9-10.4 WHST.9-10.2 WHST.9-10.4 WHST.9-10.8
Select appropriate wire and cable for use in a variety of applications	• Interpret multi-conductor wire and cable markings to determine the number and size of conductors and application categories for a multi-conductor electrical cable..	PST.02.02.02.b. PST.03.02.03.b. PST.04.04.02.a.

	• Use tables of standards (American Wire Gauge (AWG) & Metric Wire Gauge Wire Sizes, to select wire sizes and insulation types appropriate to different voltages, currents, applications and locations. (Using the National Electrical Code®(NEC®) Ampacity Charts: Determining Current-Carrying Capacity of Conductors, Residential Electrical Code Requirements - The Home Depot)	PST.04.04.02.c. RST.9-10.4 WHST.9-10.8 WHST.9-10.9
Select circuit breakers, fuses and ground fault circuit interrupters for different applications.	• Compare and contrast the purpose and function of circuit breakers, fuses and ground fault circuit interrupters (GFCI), (Introduction to Circuit Protection Devices) • Identify places where code would require installation of a GFCI. (GFCI Fact Sheet) • Wire a GFCI duplex outlet in series with a standard duplex outlet to provide ground fault protection to the entire circuit.	PST.02.02.02.b. PST.03.02.02.a. PST.03.02.03.a. PST.03.02.03.b. PST.04.04.02.a. PST.04.04.02.c. RST.9-10.3 WHST.9-10.9

Unit 2	Plumbing Safety and Practice
Essential Questions	1. How do I work safely with plumbing? 2. Which type of plumbing and fixtures should be used for different applications?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CS.03.04.01.a. Identify and differentiate the appropriate protective equipment for the safe use and operation of specific tools and equipment (e.g. PPE, etc.). CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment. PST.01.02.03.b. Select, maintain and demonstrate the proper use of tools, machines and equipment used in different AFNR related mechanical systems. PST.02.01.01.a. Maintain the cleanliness and appearance of equipment, machinery and power units used in AFNR power, structural and technical systems to assure proper functionality. PST.04.03.04.a. Compare and contrast the characteristics of materials used in plumbing and water systems (e.g., copper, PVC, PEX, etc.). PST.04.03.04.c. Install and/or repair pipes and plumbing equipment and fixtures in AFNR structures.
Common Core State Standards	RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics. MP 4 Model with mathematics.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	AQ.09.01.03.c. Construct a recirculating aquaculture system (RAS) based on dynamic interaction including flow rate, size, capacity, plumbing, friction loss, species and component requirements. CS.03.04.02.a. Identify standard tools, equipment and safety procedures related to AFNR tasks. CS.03.04.02.b. Complete the set up and adjustment for tools and equipment related to AFNR tasks. CS.03.04.03.a. Read and interpret operating instructions related to operation, storage and maintenance of tools and equipment related AFNR tasks. CS.03.04.03.b. Assess and demonstrate appropriate operation, storage and maintenance techniques for AFNR tools and equipment. ESS.04.02.01.b. Analyze environmental hazards created by different types of solid waste, solid waste accumulation and solid waste disposal. PST.04.03.01.c. Select materials for a project based upon an analysis of the project and the quality of the materials.
Common Core State Standards	WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience WHST.9-10.7 - Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. WHST.9-10.8 - Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. WHST.9-10.9 - Draw evidence from informational texts to support analysis, reflection, and research. MP 2 Reason abstractly and quantitatively.

Objectives	Activities	CT AFNR, NGSS, CCSS
Work safely and efficiently with plumbing.	• Maintain a clean and safe shop environment. • Demonstrate procedures for maintaining a safe shop such as cleaning equipment and surroundings as well as determining and eliminating potential workplace hazards. • Identify common plumbing tools and select the appropriate tools and techniques for plumbing work..	CS.03.04.01.a. CS.03.04.01.b. ESS.04.02.01.b. PST.01.02.03.b. PST.02.02.02.b. WHST.9-10.4 WHST.9-10.7 WHST.9-10.8
Employ personal protective equipment and other safety equipment to maintain safety while plumbing.	• Identify the hazards associated with plumbing and the use of plumbing equipment such as hand tools, power tools and torches. • Identify safety practices and PPE for plumbing.	CS.03.04.01.a. CS.03.04.01.b. ESS.04.02.01.b.
Compare and contrast common types of pipe used for water supply, drains and heating in agricultural and residential settings.	• Describe the different working properties and appropriate application of different types of plumbing such as copper, black iron, ABS, PVC, CPVC and PEX. • Evaluate or select plastic pipe for different applications based upon identifying information on the pipe and industry recommendations of applications and maximum temperature and pressure ratings.	PST.04.03.04.a.
Assemble and Disassemble plumbing pipe, fixtures and fittings	• Use pipe cutters, reamers and brushes to prepare copper pipe for installation. • Sweat solder a simple plumbing fixture that uses copper fittings and elbows. Connect the fixture to a water source and test it under pressure for leaks. • Solvent weld a simple plumbing fixture that uses PVC fittings and elbows. Connect the fixture to a water source and test it under pressure for leaks. • Use cutters and crimping tools to assemble plumbing using Cross-linked polyethylene (PEX) tubing. • Assemble and disassemble plumbing fittings associated with a sink supply and drain lines. • Install a sink, toilet or other fixture on a mockup of a kitchen, bathroom, etc… • Replace the flush mechanism in a toilet tank.	CS.03.04.01.a. CS.03.04.01.b. ESS.04.02.01.b. PST.01.02.03.b. PST.02.01.01.a. PST.04.03.04.a. PST.04.03.04.c. RST.9-10.3. RST.9-10.4

	• Identify commonly used plumbing fittings and describe how and where they are used.	
Determine plumbing friction losses	• Use Friction Loss Tables for different types of plumbing to determine friction losses for a given circuit. • Construct a water manometer and use it to measure pressures at points in a plumbing circuit. • Measure pressure and flow values in a plumbing circuit and compare measurements to those predicted using friction loss tables.	AQ.09.01.03.c. CS.03.04.01.a. CS.03.04.01.b.

Vocabulary:

ABS	Flush Valve	Lineman's Pliers	Resistor
Black Iron	Flux	Load	Safety Ground
Chassis Ground	Fuse	Neutral / Cold Wire	Semiconductor
CPVC	Gasket	Node	Single-Pole Double Throw (SPDT) / 3-Way Switch
Die Stock	Gauge	NPT	Single-Pole Single Throw (SPST) Switch
Diode	Ground	Ohm	Solder
Duplex Outlet	Ground Fault Circuit	P-Tube	Source
Electromotive Force	Interrupter (GFCI)	PEX	Sweat Solder
(EMF)	Hot Wire	Potentiometer	Voltage
Fault	Insulator	PVC	Wire Strippers

Assessments:
Quizzes
Tests
Activity reports
Skill assessments
Practical assessment of wiring projects

Connections to College/Career Readiness:
The units in this course provide students with skills needed to perform basic electrical maintenance in a home or AFNR setting and the opportunity to explore careers (Occupational Outlook Handbook, Power, Structural & Technical Systems | AgExplorer) with electricity and plumbing.

Resources/Materials:

- Text: Electrical Wiring. Duncan/ Wren. AAVIM, 1999
- Text: Wiring Basic and Advanced Projects. Creative Homeowner, 2001.
- Text: Agricultural Mechanics: Fundamentals and Application. Cooper. Delmar, 1995.
- Web: Laboratory Manual for Semiconductor Devices
- Web: Understanding Your Electric Bill | Eversource , copies of electric bills.
- Pegboard wiring boards, zip ties, receptacle and junction boxes, 3 and 4 wire #12 wire, plugs with flex cables
- PVC, PEX, copper and black iron pipe and fittings, solvent cement, lead-free acid-core solder, flux, , teflon tape
- Screwdrivers, needle-nose pliers, wire strippers, razor knives, lineman's pliers, diagonal cutters
- Plumbing tools such as propane torches, PEX crimping tool and fittings, die stocks and handles for threading black iron,
- Multimeters
- Miscellaneous small resistors, LED's, small electronic devices such as watches and basic calculators, batteries or power supplies for low-voltage circuits.

Course Title	Metal Fabrication
Agriculture Pathway	Power, Structural and Technical Systems
Length of Course	One Quarter
Ledyard High School Vision of the Graduate	Demonstrate an ability to solve problems of varying complexity across content areas. Demonstrate critical thinking skills to find solutions, support arguments, and overcome challenges in a variety of content areas.
Course Overview	This unit provides an introduction to the skills needed by students to safely work with metals in an agricultural shop. An emphasis is placed on developing skills for cold metal work and shielded metal arc welding of mild steel.
Units of Study	1. Metal as a Material 2. Metal Shop Safety 3. Metal Fabrication Technologies

Unit 1	Metal as a Material
Essential Questions	1. How do I identify different kinds of metal? 2. How do different types of metal differ in their working properties?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	PST.01.03.04.a. Compare and contrast the properties of different metals used in AFNR power, structural and technical systems (e.g., malleability, conductivity, optical properties, chemical composition, etc.).
Common Core State Standards	RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	CS.03.04.03.b. Assess and demonstrate appropriate operation, storage and maintenance techniques for AFNR tools and equipment. PST.01.02.03.b. Select, maintain and demonstrate the proper use of tools, machines and equipment used in different AFNR related mechanical systems.
Common Core State Standards	SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. WHST.9-10.2 - Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience WHST.9-10.9 - Draw evidence from informational texts to support analysis, reflection, and research. MP 2 Reason abstractly and quantitatively. MP 4 Model with mathematics

Objectives	Activities	CT AFNR, NGSS, CCSS
Interpret information about the physical characteristics of metals to make informed decisions when working with metal.	• Identify different metals encountered in the agricultural shop by visual and physical properties. • Compare and contrast the physical characteristics such as ductility, malleability and machinability of different metals encountered in agricultural practice. • Compare and contrast various steel alloys according to composition, working properties and common applications. • Use data from tables of metal properties to calculate expansion and contraction of metal when heated and cooled. • Demonstrate techniques to tack and control heat on work pieces to minimize deformation of metal when being heated. • Forge a simple shape such as an eyelet or hook from round stock. • Use tables of radiated color (Tool Steel Temperature Color Chart)and reflected colors (Forging Steel Heat & Color Chart)to estimate temperature of hot or previously heated and cooled metal. • Case harden mild steel and evaluate the change in hardness that results. • Employ spark tests to estimate the composition of steel.	CS.03.04.03.b. PST.01.03.04.a. SL.9-10.4 RST.9-10.4. WHST.9-10.2 WHST.9-10.4 WHST.9-10.9 MP 2 MP 4

Unit 2	Metal Shop Safety
Essential Questions	1. How do I work with metal safely?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CS.03.04.01.a. Identify and differentiate the appropriate protective equipment for the safe use and operation of specific tools and equipment (e.g. PPE, etc.). CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment. PST.01.02.03.b. Select, maintain and demonstrate the proper use of tools, machines and equipment used in different AFNR related mechanical systems. PST.01.03.02.a. Identify personal protection equipment (PPE) used in welding. PST.01.03.02.b. Demonstrate how to safely setup, use, and turn off oxy-acetylene welding equipment. PST.01.03.02.b. Demonstrate how to safely set up, use, and turn off shielded metal arc welding (SMAW) equipment. PST.01.03.04.b. Demonstrate how to safely set up, use, and turn off a gas metal arc welding system (GMAW).

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	PST.02.01.01.a. Maintain the cleanliness and appearance of equipment, machinery and power units used in AFNR power, structural and technical systems to assure proper functionality.
Common Core State Standards	RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. WHST.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience WHST.9-10.9 - Draw evidence from informational texts to support analysis, reflection, and research.

Objectives	Activities	CT AFNR, NGSS, CCSS
Work safely and efficiently in a metalworking shop.	• Maintain a clean and safe shop environment. • Demonstrate procedures for maintaining a safe metal fabrication shop such as cleaning equipment and surroundings as well as determining and eliminating potential workplace hazards.	PST.01.02.03.b.
Employ personal protective equipment and other safety equipment to maintain safety in the metal fabrication shop.	• Identify the hazards associated with the use of metal fabrication equipment such as power tools, arc welding machines and oxy-fuel torches. • Identify the causes and symptoms of burns associated with exposure to welding arcs. • Describe and demonstrate use of procedures and personal protective equipment to minimize the risk of injury from exposure of workers and bystanders to a welding arc. • Disassemble and reassemble a welding mask identifying key components and their functions. • Inspect a welding mask and correct any defects. • Select appropriate welding lens shades for various metalworking tasks such as brazing, cutting and welding. • Read a scenario of a welding accident and write a description of the factors that contributed to the accident and preventive measures that should be put in place to prevent recurrences.	CS.03.04.01.a. CS.03.04.01.b. PST.01.03.02.a. PST.02.01.01.a. RST.9-10.3.
Demonstrate safe practice in the selection and use of tools used in the metal fabrication shop.	• Cut bar, angle stock and rod with a metal cutting band saw, cut-off saw, plasma cutter or oxy-fuel cutting torch. • Use a drill press to drill in steel or aluminum. • Use bench and pedestal grinders to bevel metal in preparation for welding. • Use an angle grinder to cut and shape metal in preparation for welding and to remove excess metal from welds.	PST.01.02.03.b.

Unit 3	Metal Fabrication Technologies
Essential Questions	1. How and under what circumstances do I use different types of metal fabrication technologies?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	PST.01.02.03.b. Select, maintain and demonstrate the proper use of tools, machines and equipment used in different AFNR related mechanical systems. PST.01.03.01.a. Compare and contrast the principles and procedures of different welding and cutting processes (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.). PST.01.03.01.b. Analyze the situation and determine the best welding and cutting process to be used in metal fabrication. PST.01.03.01.c. Evaluate the quality of metal fabrication procedures (e.g., SMAW, GMAW, GTAW, fuel-oxygen and plasma arc torch, etc.). PST.01.03.02.b. Demonstrate how to safely setup, use, and turn off oxy-acetylene welding equipment. PST.01.03.03.a. Use the five-digit AWS classification system for selecting electrodes used in shielded metal arc welding (SMAW). PST.01.03.02.b. Demonstrate how to safely set up, use, and turn off shielded metal arc welding (SMAW) equipment. PST.01.03.04.b. Demonstrate how to safely set up, use, and turn off a gas metal arc welding system (GMAW).
Common Core State Standards	RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. MP.4. Model with mathematics.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	CS.03.04.01.a. Identify and differentiate the appropriate protective equipment for the safe use and operation of specific tools and equipment (e.g. PPE, etc.). CS.03.04.01.b. Analyze and demonstrate adherence to protective equipment requirements when using various AFNR tools and equipment PST.01.03.02.c. Construct and/or repair metal structures and equipment using shielded metal arc welding (SMAW) equipment. PST.01.03.04.c. Construct and/or repair metal structures and equipment using gas metal arc welding system (GMAW). PST.02.01.01.a. Maintain the cleanliness and appearance of equipment, machinery and power units used in AFNR power, structural and technical systems to assure proper functionality. PST.04.01.02.a. Read and interpret the parts and/or views of plans for agricultural structures.

Common Core State Standards	RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. WHST.9-10.2 - Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

Objectives	Activities	CT AFNR, NGSS, CCSS
Employ cold metal working technologies with metal.	• Use a DRILL-PRESS SPEED CHART to determine the optimum speed for drilling materials and adjust a drill press to the proper speed. • Use a Tap & Drill Chart to select the bit size to use for tapping a hole in metal. • Drill, tap and thread metal.	PST.01.02.03.b. RST.9-10.3. CS.03.04.01.a. CS.03.04.01.b. PST.02.01.01.a.
Employ technologies such as SMAW, GMAW, GTAW and Oxy-fuel to fabricate and repair metal objects.	• Draw a SMAW, GMAW or GTAW welding circuit, identifying and describing the function of the various components. • Use oxy-fuel technology to solder, braze or weld. • Inspect welding machines and equipment for defects such as frayed cables and loose connections. Make repairs as needed. • Select SMAW welding electrodes for a given application according to polarity, electrode size, AWS electrode codes and tables of electrode characteristics. • Create tack, butt, lap and fillet joints with welding or brazing technology. Complete written reports for each joint created, including a brief analysis of the process, results of this weld and strategies to improve similar welds in the future. • Calculate duty-cycle to operate a welding machine or plasma cutter machine within the manufacturer's specifications. • Construct a simple metalworking project such as a hitch pin or welding vise. • Select the proper technology to use for a real or hypothetical metal fabrication need, giving reasons for your choice based	PST.01.02.03.b. PST.01.03.01.a. PST.01.03.01.b. PST.01.03.01.c. PST.01.03.02.b. PST.01.03.02.c. PST.01.03.03.a. PST.01.03.02.b. PST.01.03.04.b. PST.01.03.04.c. PST.02.01.01.a. PST.04.01.02.a RST.9-10.3. RST.9-10.4. SL.9-10.4 WHST.9-10.2

	on the type of metal, the situation and the characteristics of the different technologies.	

Vocabulary:

AC	Drill Press	Oxidizing Flame	Temper
Acetylene	Ductility	Pedestal Grinder	Tool steel
Alloy	Edge Joint	Porosity	Ultimate tensile strength
Ampere	Electrode	Rectifier	Ultraviolet
Angle Grinder	Electrode holder	Regulator	Weld face
Angle Stock	FCAW	Reverse polarity	Weld fusion
Anneal	Filler rod	Round bar	Weld pool
Anvil	Fillet weld	SAE size	Weld toe
Bench Grinder	Flashback	Scratch awl	Welder's flashes
Bevel	Flat bar	Slag	Work piece
Brass	Flux	Slag inclusion	
Bronze	Galvanized steel	SMAW	
Butt Weld	GMAW	Stainless steel	
Carburizing Flame	GTAW	Straight polarity	
Case Harden	Hacksaw	Tack weld	
Cast Iron	Infrared	Tap	
Center Punch	Lap joint	Tap wrench	
Cold Chisel	Malleability	Thread pitch	
Coefficient of thermal expansion	Metal fume disease	Hex bolt	
DC	Mild steel	Tee weld	

Assessments:
Quizzes
Tests
Skill assessments
Activity & weld reports
Assessment of cold metal and hot metal practical work.

Connections to College/Career Readiness:
The units in this course provide students with skills needed to perform basic metalworking in a home or AFNR setting and the opportunity to explore

careers (Occupational Outlook Handbook, Power, Structural & Technical Systems | AgExplorer) with electricity and plumbing.

Resources/Materials:
Agricultural Mechanics: Fundamentals and Applications. Cooper. Delmar, 1987.
Metal Fabrication Technology for Agriculture. Jeffus. Delmar, 2004.
Welding. Wall Mountain Company, 1996.
Oxy-Acetylene Welding. Wall Mountain Company, 1998.
New Lessons in ARC WELDING. The Lincoln Electric Company. 2011.
Metal-cutting bandsaw, chop saw, drill press and bits, HSS metal taps, metal dies, angle grinders, pedestal grinder, sand blaster
SMAW, GMAW AND GTAW machines
Oxy-fuel setup with welding and cutting tips
Mild steel and aluminum structural shapes and plate appropriate to projects.
Welding Electrodes, Welding Wire, Brazing Rods, Flux, Mild Steel Structural Stock, Fuel Gasses and Oxygen, Shield Gas, safety glasses, gas torch eye protection with a shade of 5, welding masks with shades of 10-12, welding gloves, welding aprons, head protection. Visors for grinding, grinding and cutting discs for angle-grinders, Cutting Oil, band saw blades

Course Title	Leadership
Agriculture Pathway	All Agricultural Pathways
Length of Course	One Quarter
Ledyard High School Vision of the Graduate	Demonstrate an ability to communicate information clearly and effectively through a variety of media, including written, oral, visual, musical, and/or video productions. Demonstrate critical thinking skills to find solutions, support arguments, and overcome challenges in a variety of content areas.
Course Overview	Students will have the opportunity to observe leaders, work with industry personnel, create personal documents and prepare themselves for their future careers. Students will leave this course with an editable resume, the understanding of how to create a cover letter and how to conduct themselves in an interview. Students will work on building characteristics sought after by employers.
Units of Study	1. What is Leadership? 2. Career Preparation 3. Employability Skills

Unit 1	What is Leadership?
Essential Questions	1. How do I determine the qualities of a leader? 2. How does a leader prepare themselves for the future?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CS.05.01.03.b. Assess personal goals, experiences, education and skill sets and organize them to produce the appropriate tools and develop the skills to effectively communicate about one's qualifications for an AFNR career. CRP.10.02.02.a. Identify methods for setting goals for personal improvement and continuous growth in a career area (e.g., SMART goals, training, professional development, etc.). CRP.09.01.01.b. Analyze workplace and community leaders and determine what ethical and effective leadership characteristics they demonstrate.
Common Core State Standards	RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	CRP.10.03.01.a. Summarize ways that input and/or advice from career area experts could assist in planning personal career goals. CRP.09.02.02.a. Examine and describe personal management skills (e.g., time management, prioritizing, setting goals, etc.) that are individually implemented and demonstrated in workplace and community situations.
Common Core State Standards	SL.9-10-.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research.

Learning Objectives	Activities	CT AFNR, NGSS, CCSS
Create SMART goals to be used in academic and personal settings.	● Assess interests and create SMART goals designed for long and short term. ● Determine the difference between long and short term goals. ● Create academic goals to be assessed throughout the course.	CS.05.01.03.b. CRP.10.02.02.a. CRP.09.02.02.a. RST.9-10.4. WHST.9-10.4. SL.9-10-.4
Identify qualities of a leader.	● Interview leaders in our community and determine what qualities they possess. ● Observe leaders in our local and national communities and determine common and shared traits.	CRP.09.01.01.b. CRP.10.03.01.a. CRP.09.02.02.a. RST.9-10.4. WHST.9-10.9

Unit 2	Career Preparation
Essential Questions	1. How do I prepare documents for potential employers? 2. How do I conduct a career search?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CRP.10.04.01.b. Organize personal information (e.g., goals, experiences, education, achievements, work examples, etc.) to prepare and continuously update a set of tools to aid in the pursuit of a career path. CRP.10.01.02.a. Examine career clusters and identify potential career opportunities based on personal interests, talents, goals and preferences.
Common Core State Standards	WHST.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. SL.9-10-.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	CS.05.01.03.a. Research and summarize specific tools (e.g., resumes, portfolios, cover letters, etc.) and processes (e.g., interviews, applications, etc.) needed to pursue a career in an AFNR pathway. CRP.10.01.01.a. Determine personal interests, talents, goals and preferences for potential careers.
Common Core State Standards	WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research. RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Objectives	Activities	CT AFNR, NGSS, CCSS
Organize personal information in a professional manner	● Create a master resume that allows students to continually add personal achievements to. ● Create a cover letter for a potential employer. ● Create thank you letters for volunteers in the agricultural program. ● Learn to create a portfolio (virtual and hard copy) of work to submit to a potential employer.	CRP.10.04.01.b. CS.05.01.03.a. CRP.10.01.01.a. WHST.9-10.7 WHST.9-10.9 RST.9-10.4. SL.9-10-.4 RST.9-10.3.
Identify how to find a potential job opening.	● Utilize different web resources to search for jobs. ● Identify personal interest to help determine potential careers. ● Take online job search quizzes to find potential matching careers.	CRP.10.01.02.a. CRP.10.01.01.a. WHST.9-10.7 WHST.9-10.9 RST.9-10.4.

Unit 3	Employability Skills
Essential Questions	1. How can I prepare myself for employment? 2. How do I develop the qualifications desired by an employer?

Priority Standards Assessed in Learning

Connecticut Agriculture, Food, and Natural Resources Standards	CS.05.01.02.a. Examine the educational, training and experiential requirements to pursue a career in an AFNR pathway (e.g., degrees, certifications, training, internships, etc.). CRP.09.02.02.a. Examine and describe personal management skills (e.g., time management, prioritizing, setting goals, etc.) that are individually implemented and demonstrated in workplace and community situations. CRP.04.01.02.b. Apply strategies for speaking with clarity, logic, purpose and professionalism in a variety of situations in formal and informal settings.
Common Core State Standards	SL.9-10-.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Supporting Standards

Connecticut Agriculture, Food, and Natural Resources Standards	CRP.10.02.01.a. Categorize career advancement requirements for potential careers (e.g., degrees, certification, training, etc.). CRP.04.01.01.a. Identify and categorize strategies for ensuring clarity, logic, purpose and professionalism in verbal and non-verbal communication (e.g., vocal tone, organization of thoughts, eye contact, preparation, etc.).
Common Core State Standards	WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research. WHST.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Objectives	Activities	CT AFNR, NGSS, CCSS
Identify qualities needed for employment.	• Research qualities required for a specific job and update resume accordingly. • Identify the differences between required qualifications and preferred qualifications. • Demonstrate transferable skills.	CS.05.01.02.a. CRP.09.02.02.a. CRP.10.02.01.a WHST.9-10.4. WHST.9-10.9 WHST.9-10.7
Demonstrate qualities needed for public speaking.	• Conduct mock interviews with peers. • Practice public speaking skills using extemporaneous speaking guidelines. • Participate in Who's the Boss with classmates. • Act out scenes without communication to focus on one's non-verbal communication.	CRP.04.01.02.b. CRP.04.01.01.a. SL.9-10-.4 WHST.9-10.4. WHST.9-10.9 WHST.9-10.7

Vocabulary:

Body Language
Cover Letter
Employability
Employee
Employer
General Traits
Interview
Job Specific Traits
Non-Verbal Communication
Oral Communication
Professionalism
Resume
Skills
Tax Witholdings
Taxes

Assessments:

Quizzes
Tests
Projects
Authentic experience reflections
Resume
Cover letter

Connections to College/Career Readiness:
This course prepares students for real life experiences and gives them information on preparing documentation for employment.

Resources/Materials:
Employment Skills LDE
Extemporaneous Public Speaking
UConn Center for Career Development
Occupational Outlook Handbook
https://www.agcareers.com/