MRSC A146: INTRODUCTION TO AQUAPONICS

Item	Value
Curriculum Committee Approval Date	03/12/2025
Top Code	010900 - Horticulture
Units	2 Total Units
Hours	72 Total Hours (Lecture Hours 18; Lab Hours 54)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Open Entry/Open Exit	No
Grading Policy	Standard Letter (S)

Course Description

This course is designed to introduce students to the science of aquaponics — a sustainable method of food production that combines aquaculture (raising fish) and hydroponics (growing plants in water) for a variety of applications. Through a blend of lectures and hands-on lab work based in our aquaponics greenhouses, students will gain both theoretical knowledge and practical skills essential for understanding and implementing aquaponic systems at various scales. Enrollment Limitation: HORT A146; students who complete MRSC A146 may not enroll in or receive credit for HORT A146. Transfer Credit: CSU.

Course Level Student Learning Outcome(s)

1. Design and Construct Aquaponic Systems: Students will be able to design and construct functional aquaponic systems tailored to various scales and environments. They will demonstrate proficiency in selecting appropriate materials, integrating components, and ensuring system stability and efficiency.
2. Manage Biological and Chemical Processes: Students will understand and manage the biological and chemical processes essential for maintaining a balanced aquaponic system. This includes monitoring and adjusting water quality parameters, ensuring the health of both aquatic and plant life, and implementing effective pest and disease management strategies.
3. Evaluate the Economic and Environmental Impact: Students will critically evaluate the economic viability and environmental benefits of aquaponic systems. They will be able to assess potential market opportunities, understand the cost-benefit dynamics, and articulate the role of aquaponics in promoting sustainable agriculture and food security.

Course Objectives

- 1. Foundational Knowledge: Understand the basic principles of aquaponics, including the symbiotic relationship between fish and plants.
- 2. System Design: Learn how to design and construct efficient aquaponic systems suitable for various scales and environments.
- 3. Biology and Ecology: Explore the biological and ecological aspects of aquaponics, including fish and plant species selection, nutrient cycling, and system balance.
- 4. Water Quality Management: Gain insights into maintaining optimal water quality for healthy plant and fish growth.
- 5. Integrated Pest Management: Discover methods for managing pests and diseases in an environmentally friendly manner.
- 6. Economic and Social Impact: Analyze the economic viability and social implications of aquaponics as a sustainable food production method.

Lecture Content

Session 1: Introduction to Aquaponics Lecture: Overview of Aquaponics: History, Significance, and Basic Principles. Session 2: The Science Behind Aquaponics Lecture: Understanding the Nitrogen Cycle and its Importance in Aquaponics. Session 3: System Components and Design Basics Lecture: Key Components of an Aquaponic System and Basic Design Considerations. Session 4: Water Quality Management Lecture: Parameters for Water Quality and Their Impact on System Health. Session 5: Fish in Aquaponics Lecture: Selecting and Managing Fish for Aquaponic Systems. Session 6: Plants in Aquaponics Lecture: Choosing Plants for Aquaponics and Understanding Nutritional Needs. Session 7: The Ecosystem Approach Lecture: Creating a Balanced Ecosystem within Aquaponic Systems. Session 8: System Cycling and Balancing Lecture: The Process of Cycling a New System and Achieving Biological Balance. Session 9: Daily and Weekly Maintenance Lecture: Routine Maintenance Tasks for Aquaponic Systems. Session 10: Integrated Pest Management Lecture: Pest Management Strategies in Aquaponic Systems. Session 11: Harvesting Techniques Lecture: Best Practices for Harvesting Fish and Plants from Aquaponic Systems. Session 12: Troubleshooting and Problem-Solving Lecture: Common Issues in Aquaponic Systems and How to Address Them. Session 13: Enhancing System Efficiency Lecture: Techniques for Optimizing Aquaponic System Performance. Session 14: Innovations in Aquaponics Lecture: Exploring Advanced Technologies and Innovative Desi gns in Aquaponics. Session 15: Sustainability and Environmental Impact Lecture: The Role of Aquaponics in Sustainable Agriculture and Food Production. Session 16: Course Wrap-Up and Reflection Lecture: Recap of the Course, Key Takeaways, and Future Directions in Aquaponics.

Lab Content

Session 1: Introduction to Aquaponics Lab: Exploration of OCC's Aquaponic Greenhouses. Session 2: The Science Behind Aquaponics Lab: Detailed analysis of nitrogen cycle and equipment in working system. Session 3: System Components and Design Basics Lab: Key Components of an Aquaponic System and Basic Design Considerations. Session 4: Water Quality Management Lab: Parameters for Water Quality and How to Properly Test Water Parameters. Session 5: Fish in Aquaponics Lab: Selecting and Managing Fish for Aquaponic Systems. Session 6: Plants in Aquaponics Lab: Choosing Plants for Aquaponics and Understanding Nutritional Needs. Session 7: The Ecosystem Approach Lab: Creating a Balanced Ecosystem within Aquaponic Systems. Session 8: System Cycling and Balancing Lab: The Process of Cycling a New System and Achieving Biological Balance. Session 9: Daily and Weekly Maintenance Lab: Routine Maintenance Tasks for Aquaponic Systems. Session 10: Integrated Pest Management Lab: Pest Management Strategies in Aquaponic Systems. Session 11: Harvesting Techniques Lab: Best Practices for Harvesting Fish and Plants from Aquaponic Systems. Session 12: Troubleshooting and Problem-Solving Lab: Common Issues

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Method(s) of Instruction

- Lecture (02)
- Lab (04)

Instructional Techniques

This class will employ a variety of instructional techniques. Weekly lab meetings will incorporate class discussions led by the instructor on the life support operation and maintenance of various aquaponics systems. Student presentations on special topics will commonly accompany these discussions. Guest speakers and field trips will help provide additional specialized information. Students will engage in a variety of hands-on practice and application of techniques discussed in class. Group evaluation of existing OCC Aquaponics greenhouse systems and organisms will be a consistent theme.

Reading Assignments

Students will read and analyze scholarly articles on various aspects of aquaponics, such as recent advancements in technology, case studies, and scientific research on plant and fish interactions. These readings will form the basis for class discussions and written assignments. Students must complete 1.5 hours of reading each week from the academic articles.

Writing Assignments

(1) Research Paper, (2) System Design Proposal, and Reflection Essay

Out-of-class Assignments

(1) Site Visit, (2) System Monitoring, and (3) Group project.

Demonstration of Critical Thinking

(1) Site Visits - Photo Essay: Students will create a photo essay documenting their site visits, with captions explaining the significance of each photo. This visual approach can enhance understanding and retention of information. (2) System Monitoring - Show-and-Tell: Students will bring in samples or demonstrate aspects of their home systems, explaining their processes and troubleshooting methods. This hands-on evaluation will assess practical skills and understanding. (3) Group Project - Peer and Self-Assessment: Incorporate peer and self-assessment to gauge individual contributions and teamwork dynamics. Students will reflect on their roles and provide feedback on their peers participation.

Required Writing, Problem Solving, Skills Demonstration

1. Writing Assignments a. Research Paper: Peer Review: Students will participate in a peer review process, providing constructive feedback on each other s papers. This will encourage critical thinking and help them learn from different perspectives 2. Problem Solving b. System Design Proposal: Simulation: Students will use software to create virtual models of their proposed systems, allowing the panel to visualize and interact with the designs. 3. Skill Demonstration c. Reflection Essays: Creative Mediums: Students will express their reflections through creative mediums like blogs, podcasts, or video diaries, catering to different learning styles and enhancing engagement.

Eligible Disciplines

Biological sciences: Master's degree in any biological science OR bachelor's degree in any biological science AND master's degree in biochemistry, biophysics, or marine science OR the equivalent. Master's degree required.

Textbooks Resources

1. Required Brooke, N. . quaponics For Beginners: How To Build Your Own Aquaponic Garden That Will Grow Organic Vegetables, ed. Independently published, 2023 2. Required Timmons, M.B., Guerdat, T., and Vinci, B.J. . Recirculating Aquaculture, 5th ed. Ithaca Publishing Company, LLC, 2022

Other Resources

1. Handouts (pdfs)