



HYDROPONIC SYSTEMS

PLS 3421C – 3 credits

ORH 4932 - 2 credits

Summer B 2019



MEETING TIMES AND LOCATION

Lecture: Online asynchronous
Practicum (only for PLS 3421C): Tuesday 2nd-3rd period
Thursday 2nd period
Fifield Hall room 2316 and Horticultural Sciences Teaching Garden

INSTRUCTORS

Dr. Gerardo Nunez g.nunez@ufl.edu
Horticultural Sciences Dept. 1113 Fifield Hall
Office hours: Mondays 9:30AM-11:30AM

Dr. Celina Gómez cgomezv@ufl.edu
Environmental Horticulture Dept. 2543 Fifield Hall
Office hours: Mondays 9:30AM-11:30AM

PRE-REQUISITES HOS 3020C or PLS 3004C

COURSE DESCRIPTION

This course offers students foundational information and hands-on experience on hydroponic and soilless cultivation of horticultural crops. Production practices, growing systems, new technologies, and current challenges are discussed.

COURSE FORMAT

This course is taught through asynchronous online lectures delivered through Canvas (all sections) and a hands-on practicum (section PLS3421C only). Lectures, learning materials, and assessments go “live” every Monday at 9:00 AM. Discussion posts are due on Wednesdays by 11:59PM. All other assignments in this course are due at 11:59 PM on Sundays.

LEARNING OBJECTIVES

Upon successful completion of this course, students will be able to:

- Describe essential components of single-pass and recirculating hydroponic systems
- Compare different substrates and hydroponic system designs
- Interpret water quality analysis results and recommend corrections
- Create nutrient solutions using salts or mixed fertilizers

- Evaluate the importance of water quality, dissolved oxygen, salinity, and pH management for hydroponic production
- Select hydroponic systems for production of leafy greens, herbs, solanaceous crops, and woody ornamentals
- Apply solution chemistry knowledge and plant biology concepts to manage hydroponic systems

COURSE MATERIALS

There is no required textbook for this course. These two textbooks are valuable reference sources.

- Hydroponics for the Home Grower – Howard M. Resh ISBN 978-1-14822-3926-3
- How to hydroponics – Keith Roberto ISBN 0-96-72026-0-4

Digital copies of this syllabus, as well as handouts, videos, and other instructive materials will be delivered via canvas. Maps to all locations relevant to the course will also be available here.

- *E-Learning in Canvas*, www.elearning.ufl.edu

This is a summer course in Florida. Sun protection and hydration should be your personal priorities. More information on sun protection can be found here.

- *Summer Sun Safety* – Moffitt Cancer Center, <https://moffitt.org/take-charge/take-charge-story-archive/summer-sun-safety-month-learn-to-protect-yourself-year-round/>

COURSE GRADE (PLS 3421C/ORH 4932)

1. Weekly quizzes 250 points

Each quiz will be worth 50 points, and there will be 5 quizzes during the semester. Each quiz will be timed to 40 minutes, and it can only be taken once. Each quiz will consist of 10 multiple-choice and essay-style questions and will become available on Friday at 9:00 AM, and they will be due Sunday at 11:59 pm. Students can refer to personal notes, websites, or any reference materials to complete the quiz. However, each student must work individually. Make up quizzes will be provided in accordance with the policy described below.

2. Weekly discussion 250 points

Hydroponic and soilless growth systems are buzzworthy these days. During weeks 1-5, the instructors will post an article from popular media that highlights an advantage, challenge, or opportunity faced by the industry. Students will write a 150-word reaction piece, provide one question about the article to prompt discussions (both due by Wednesday each week), and comment on two reaction pieces from classmates (by Sunday each week). Both the reaction piece and the comment are to be submitted in the Discussions tab in canvas.

Participation in the discussion will be graded on a weekly basis using the following rubrics:

Reaction piece	Strongly disagree	Neither agree or disagree	Strongly agree
	Possible points		
	1-8	9-16	17-25
The reaction piece and question reflect that the student read and understood the assigned article.			
The reaction piece and question have a clear purpose: inform, persuade, or encourage discussion.			
The reaction piece was written following the instructions (minimum word requirement).			

The question is engaging and moves the conversation forward.			
The reaction piece and question are written using professional grammar, punctuation, and vocabulary.			

Peer comments	Strongly disagree	Neither agree or disagree	Strongly agree
	Possible points		
	1-8	9-16	17-25
Comments are substantive and reflect that the student read and understood classmates' reaction pieces.			
Comments answered a pending question, are engaging, and move the conversation forward.			
Comments indicate agreement with a classmate's post or offer an alternative viewpoint.			
Comments address classmates and instructors in a respectful, professional manner.			
Comments are written using professional grammar, punctuation, and vocabulary.			

3. Nutrient solution formulation exercise

150 points

The calculations necessary to mix a nutrient solution are critical for hydroponic production. This take-home exercise will test your quantitative skills to formulate a nutrient solution. This assignment will be posted on 7/22/19 and it is due on 8/4/19 at 11:59PM. You can refer to personal notes, websites, or any reference materials, but you must work individually. You must show all calculations either through a scanned document or a spreadsheet. If your calculations are carried out by hand, please write as legibly as possible.

4. Practicum

150 points

This course includes five hands-on practical activities where students get to assemble, operate, disassemble, and sanitize hydroponic systems. Each week, there will be assigned reading materials that must be completed before the lab session. We will meet in Fifield 2316 to receive instructions and carry out demonstrations for the practicum. Then, the class moves to greenhouse 441 east in the Horticultural Sciences Teaching Garden, where the practical activities will happen. We will work in teams of 2 students. Participation in the practical activities will be evaluated by your peers and the instructor after each activity using the following rubric. Peer evaluation scores from each activity will be averaged and added to the instructor score. The sum of scores in all activities will be your total score for the practicum.

Performance criteria	Strongly disagree	Neither agree or disagree	Strongly agree
	Possible points		
	1-2	3	4-5
Background: The student is able to identify and describe necessary basic concepts for completion of the project.			
Task completion: The student contributed to completing the task according to the instructions.			

Team work: The student is responsible for an element of the team's success.			
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5. Final exam

200 points

The final exam will be a take-home comprehensive test. Students will be presented with a hydroponic production scenario and asked to select among available technologies, strategies, and tradeoffs. The final exam will be posted on 08/05/019 at 9:00AM and it is due on 08/09/19 at 11:59PM. The final exam can be submitted as a .doc or .pdf file in Canvas. Students can use reference materials (class slides, textbooks, etc.), but they must work individually and cite their sources as appropriate.

Grading scale

Assessment	PLS 3421C	ORH 4932
Weekly quizzes	250	250
Weekly discussion	250	250
Nutrient solution formulation	150	150
Practicum	150	150
Final exam	200	200
Maximum possible points	1,000	850

Letter grades will be assigned according to the following standard percentages:

A	=	90 - 100 %	C	=	70 - < 77 %
B+	=	87 - < 90 %	D+	=	67 - < 70 %
B	=	80 - < 87 %	D	=	60 - < 67 %
C+	=	77 - < 80 %	E	=	< 60 %

Additional information on current UF grading policies for assigning grade points can be found here:

- *Grading policy*, <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>.

COURSE POLICIES

Attendance and Make-up Policy

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at:

- *UF Attendance policy*, <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Academic Honesty

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity." You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of

Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action.

- For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>

Software Use

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken when appropriate.

Services for Students with Disabilities

Students with disabilities requesting accommodations should first register with the Disability Resource Center by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

- *Disability Resource Center*, 0001 Reid Hall, (352) 392-8565, www.dso.ufl.edu/drc/

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- *Counseling and Wellness Center*, 3190 Radio Road, 392-1575, www.counseling.ufl.edu
 - Counseling Services
 - Groups and Workshops
 - Outreach and Consultation
 - Self-Help Library
 - Wellness Coaching
- *U Matter We Care*, www.umatter.ufl.edu
- *Sexual Assault Recovery Services (SARS)*, Student Health Care Center, 392-1161.
- *University Police Department*, 392-1111 (or 9-1-1 for emergencies), www.police.ufl.edu

Additionally, if you would like orientation on choosing a major, finding an internship, or planning your career, I encourage you to use the university's on-campus resources.

- *Career Connections Center*, CR-100 Reitz Union, 392-1601, <https://career.ufl.edu/>

Course Evaluation Process

Student assessment of instruction is an important part of the effort to improve teaching and learning. At the end of the semester, you are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. These evaluations are conducted online at:

- *Course evaluations*, www.evaluations.ufl.edu

Evaluations are typically open during the last two or three weeks of the semester. You will be notified of the specific times when evaluations for this course are open. Summary results of these assessments are available to students at:

- *Evaluations summary*, www.evaluations.ufl.edu/results

Student Complaints

You can file and resolve any complaints about your experience in this course in the following site:

- *Student complaints in online courses*, <http://distance.ufl.edu/student-complaint-process/>

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Summer B 2019

Date	Topic	Instructor
Module 1	Controlled Environment Agriculture and hydroponics: Past, present, and future	Celina Gómez
	Advantages and disadvantages of hydroponics	
	Uses of hydroponic systems	
	Hydroponic crops	
	Basic production principles	
	<i>Practicum: Assembling and operating NFT and DWC systems</i>	
Module 2	Growing substrates	Celina Gómez
	Substrate-based systems	
	Liquid systems	
	System components	
	Cultural practices	
	<i>Practicum: Assembling and operating vertical planters and ebb and flood systems</i>	
Module 3	Alkalinity and pH	Gerardo Nunez
	Alkalinity corrections using AlkCalc	
	Electrical conductivity, toxic elements, biological contaminants	
	Cultural practices and water conservation	
	Water sampling	
	Using pH, EC, DO, and ion sensors for hydroponic production	
	<i>Practicum: Environmental sensors in hydroponic production</i>	
Module 4	Introduction to nutrient solutions	Gerardo Nunez
	Fertilizers and labels	
	Mixing nutrient solutions – part 1	
	Mixing nutrient solutions – part 2	
	Practical problems with nutrient solutions – part 1	
	Practical problems with nutrient solutions – part 2	
	<i>Practicum: Aeroponics, fogponics, and wick-based systems</i>	
Module 5	Fertilizer injectors	Gerardo Nunez
	ABC system of fertilizer injectors	
	Practical problems with fertilizer injectors – part 1	
	Practical problems with fertilizer injectors – part 2	

	Basic principles of organic nutrition	
	Organic hydroponics	
	<i>Practicum:</i> Mixing a custom-made nutrient solution	
Module 6	Introduction to aquaponics	Celina Gómez
	Aquaponic systems and components	
	Food safety	
	Sanitation	
	Common errors with hydroponic production	
	<i>Practicum:</i> Injector demo, organic hydroponics, and cleaning & sanitizing hydroponics systems	