



**BE 350 LECTURE:  
Advanced Hydroponic Crop Production  
3 Credits, Spring 2021  
Live Online or icourse**

**Day/Time: Tuesday/Thursday 1:00-2:15pm (Zoom)**

**Description of Course**

This is an advanced level course, building on the basic principles covered in BE 217: Introduction to Hydroponics. Students will gain experience in nutrient formulation, fertigation management, and plant health monitoring; design and management of fertigation systems; cultivation of different types of crops (ex. lettuce, peppers, cucumbers, hemp, mushrooms, strawberries) in various types of hydroponic systems and environments; the effect of various environmental parameters on plant production (ex. vapor pressure deficit, artificial lighting), and understanding of the principles and challenges in developing organic hydroponic systems. Students will read and analyze primary literature involving hydroponic systems and develop the ability to troubleshoot and solve grower problems.

**Course Prerequisites or Co-requisites**

BE/PLS 217: Introduction to Hydroponics.

**Instructor and Contact Information**

Name	Dr. Stacy Tollefson
Office Location	CEA Building Room 103
Telephone number	520-626-9953
E-mail address	stollefson@arizona.edu
Office Hours/"Open Door Policy"	By appointment
Web information:	Current semester info available through D2L.

**Course Format and Teaching Methods**

During the Spring 2021 semester, this course will combine the "Live-Online" and "icourse" sections of the course. Material and course requirements are the same for both classes and the two classes will be combined in one D2L site. The only difference will be that the "Live-Online" students will have some live lectures, with those being recorded for icourse students, and Live-Online students, to view afterwards. The course readings, videos, and assignments will all be accessible in D2L, with graded work turned in to D2L. The midterm and final exams will be taken through D2L.

**Course Objectives**

The course objective is for students to gain advanced understanding of how to grow crops

successfully in hydroponic systems. This includes an understanding of how to develop and managing crop nutrition and environmental parameters to attain optimized growth. It also includes learning how to grow a number of different crops in different types of systems and maintain food safety.

## **Expected Learning Outcomes**

**The expected learning outcomes are for students to be able to:**

1. Calculate and adjust nutrient formulae, manage fertigation, and identify nutrient deficiencies through data and images.
2. Describe nutrient requirements, environmental conditions, and cultural practices for growing vining crops, leafy greens, hemp, and mushrooms using hydroponics and controlled environments.
3. Demonstrate an understanding of hemp regulations through the Farm Bill and Arizona State Statutes and hemp growing practices in controlled environments.
4. Describe principles and challenges when using organic hydroponic methods.
5. Critically read, review, and analyze research papers of studies in hydroponics.
6. Synthesize and apply principles of hydroponic/CEA growing to troubleshoot and solve grower problems.

This course aligns to all five Student Learning Outcomes for the Sustainable Plant Sciences Major:

This course will provide the students with opportunities to:

- 1) Integrate and apply the general principles of Sustainable Plant Systems to specific plant production systems (Hydroponics and CEA) [High]
- 2) Demonstrate an understanding of the history, current conditions, and future challenges associated with plant sciences and production systems on a local and global scale.
- 3) Apply the basic principles of plant biology and soil science to plant production systems.
- 4) Think critically as demonstrated by evaluating information from multiple perspectives, drawing reasonable conclusions, and defending them rationally.
- 5) Communicate effectively principles and technical terms associated with plant production systems both orally and in writing.

This course aligns to two of the Student Learning Outcomes for the Agriculture Technology Management Major:

- 1) Fulfills knowledge for topic area of Controlled Environment Agriculture
- 2) Students will be able to work cooperatively with others.

This course aligns to five the Student Learning Outcomes for the Biosystems Engineering Major:

- 1) Can apply mathematics, science, and engineering principles to solve problems.
- 2) Can use the techniques, skills, and modern engineering tools necessary for engineering practices.
- 3) Has the broad education necessary to understand the impact of engineering solutions in global, economic, environmental, and societal context.
- 4) Has a knowledge of relevant contemporary issues.
- 5) Can communicate effectively.

## **Absence and Class Participation Policy**

We will be meeting on-line via Zoom on Tuesday and Thursday at 1:00pm – 2:15pm if you are taking it as LIVE ONLINE, unless we decide differently as a class. The plan is that those lectures will be recorded and made available to all students, including those who are taking the icourse so they can access them on their own time.

Students are expected to access D2L on a timely basis to access all course materials. All graded work will be turned in through D2L.

If you become ill and unable to complete coursework and assignments, contact me right away so we can work out delayed due dates and/or for you to take an incomplete.

Dropping the course once it has begun:

If you decide to drop the class once it has begun (once you have been assigned a rep of plants, i.e., after the first class meeting), please notify the instructor.

Please see University withdrawal procedures:

<http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal>

## **Makeup Policy for Students Who Register Late**

Students who register after the first class meeting must make up all assignments and online discussions within 3 days of first day of attendance, or time agreed upon by instructor.

## **Course Communications**

All course communications will be done through email and D2L. You may email be anytime at [stollefson@arizona.edu](mailto:stollefson@arizona.edu). **DO NOT use the D2L email. I don't get those emails!**

## **Required Texts or Readings**

There is no required textbook. All course materials will be provided to you on D2L. There is an optional text online “PLS 217 Class Notes: Intro to Hydroponics and CEA” that is available for free on the UA-CEAC website at <https://ceac.arizona.edu/students/ua-courses/bepls-217> I may refer to these chapters and post certain chapters on D2L for you to read.

## **Required or Special Materials**

Students will need a computer with Internet access and camera so that they can access D2L and use Zoom.

## **Assignments and Examinations: Schedule/Due Dates**

All readings, videos, Powerpoints, and assignments will be posted to D2L under each module along with due dates. Assignment due dates will be listed when assigned, and must be uploaded to D2L by 11:59pm on the due date.

Both exams will cover readings, videos, assignment, and lecture material. The Midterm Exam will cover material in the modules before that exam. The Final Exam will not be comprehensive. It will cover material from the modules after the Midterm. The **Midterm Exam will be taken on March 4** and the **Final Exam on May 11**. These exams will be posted on the exam day and students can take it at any time that day. However, once you start taking the test you will have 2 hours to complete the exam from the time you started. The exams must be completed by 11:59pm on the exam day.

## **\*Discussions**

There will be a general discussion forum for any questions or thoughts you have about the course. This may be questions about assignments, or questions or thoughts about topics or extensions of topics. This can be used to interact with me but also get thoughts from your peers. Sometimes I will post discussion questions or things to think about. These discussions are not required, but they will enhance your learning experience. Discussions are an opportunity for extra credit. Each time you post something to a discussion, you will earn a point toward your final grade (as long as it is a question or comment pertinent to the class!). You may receive up to 10 extra points throughout the semester. If you post more than 10 times, that's great but you are capped at a maximum of 10 points.

## **Final Examination**

The Final exam will cover readings, videos, assignment, and lecture material from the modules after the Midterm. The Final Exam will be on May 11. The exam can be taken at anytime that day but once you start it, you must complete it within 2 hours from the start time. The exam must be completed by 11:59pm that day.

## **Grading Scale and Policies**

**FINAL GRADE** = 400pts Total

<b>LECTURE GRADE</b>	<b>Pts</b>
Assignments (8@25pts each)	200
Midterm Exam	100
Final Exam	100
*Discussions (extra credit <=10pts)	10*
<b>TOTAL</b>	<b>400</b>

### **Grading Scale**

A = 358 -400 pts  
B = 318 - 357 pts  
C = 278 - 317 pts  
D = 238 – 277 pts  
F < 238 pts

Late work policy: Assignments must be turned in to D2L by 11:59pm on the date due. A grade of “0” will be assigned if the work is turned in after the due date/time, unless otherwise agreed upon by the instructor.

Testing policy: All tests will cover readings, videos, assignment, and lecture material. The Midterm Exam will be taken March 4 and the Final Exam on May 11. See exam section for more information.

Requests for incomplete (I) or withdrawal (W): Must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively. Incomplete grades must be verified with a written agreement between the instructor and student. This agreement will specify the work to be done and a timetable of completion.

## **Classroom Behavior Policy - Nettiquitte**

Nettiquette = manner rules for the digital age.

Important! These rules apply whether you are communicating with your professor or another student!

**Communication:** Maintain the same standard of behavior and ethics that you would follow in a professional, face-to-face context.

**Tone:** Treat others with respect. Be mindful of your tone and how that is conveyed in your writing style. DO NOT USE ALL CAPS. It is considered shouting and not appropriate in a classroom. Avoid sarcasm and irony as it is easily misinterpreted in an online environment.

**Clarity and Content:** Be succinct. Write, reread, and then post. Carefully consider what you have written. Does it make sense? Is it free from errors? Is it substantive? Is it unnecessarily confrontational or offensive?

**Contribute:** Share your knowledge and insight. Be an active contributor to the learning community.

**Be forgiving:** If someone makes a mistake or does something inappropriate, address it privately and politely. Reach out to that person first. If that does not address the situation, let your instructor know.

## **Class recordings, Powerpoint Lectures Use**

For lecture recordings and Powerpoint lectures, which are used at the discretion of the instructor, students must access content in D2L only. Students may not modify content or re-use content for any purpose other than personal educational reasons. All recordings are subject to government and university regulations. Therefore, students accessing unauthorized recordings or using them in a manner inconsistent with UArizona values and educational policies are subject to suspension or civil action.

## **Threatening Behavior Policy**

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

## **Accessibility and Accommodations**

Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact the Disability Resource Center (520-621-3268) to establish reasonable accommodations. For additional information on the Disability Resource Center and reasonable accommodations, please visit <http://drc.arizona.edu>.

## **Code of Academic Integrity**

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See:

<http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

## **UA Nondiscrimination and Anti-harassment Policy**

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

## **Additional Resources for Students**

Academic advising: If you have questions about your academic progress this semester, or your chosen degree program, please note that advisors at the Advising Resource Center can guide you toward university resources to help you succeed. UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>

Student Assistance and Advocacy information is available at <http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

Life challenges: If you are experiencing unexpected barriers to your success in your courses, please note the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office can be reached at 520-621-2057 or [DOS-deanofstudents@email.arizona.edu](mailto:DOS-deanofstudents@email.arizona.edu).

Physical and mental-health challenges: If you are facing physical or mental health challenges this semester, please note that Campus Health provides quality medical and mental health care. For medical appointments, call (520-621-9202. For After Hours care, call (520) 570-7898. For the Counseling & Psych Services (CAPS) 24/7 hotline, call (520) 621-3334.

## **Confidentiality of Student Records**

<http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>

## **Subject to Change Statement**

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.

**BE 350: Advanced Hydroponic Crop Production**  
**COURSE SCHEDULE**  
**SPRING 2021**

**INSTRUCTOR:** Dr. Tollefson

(Schedule subject to change)

<b>Week of</b>	<b>Module</b>	<b>Assignments Due</b>
January 14	Introductory Module, Go over syllabus.	
January 18	Module 1: Nutrient formulae, how to make and refill tanks	
January 25	Module 2: How to create recipes	HW 1: Tank Refills
February 4	Module 3: Fertigation systems design	HW 2: Create Recipe
February 1	Module 4: Fertigation and GH Layout	
February 8	Module 5: Managing re-circulating systems	HW 3: GH Layout
February 15	Module 6: Other nutrition management considerations: Alkalinity, flow rate, EC and DOM, oxygen	
February 22 (Feb 25-reading day)	Module 7: Leafy greens, pepper, cucumber production	HW 4: Recirculating
March 1	<b>March 4: MIDTERM EXAM</b>	
March 8 (March 9 – Reading day)	Module 8: Hemp Production	
March 15	Module 8 : Hemp Production cont'd	
March 22	Module 8: Hemp Production cont'd	HW 5: Hemp Production
March 29	Module 9: Aquaponics	
April 5	Module 10: Vapor Pressure Deficit Module 11: Lighting	HW 6: Aquaponics
April 12	Module 12: Troubleshooting Activity Module 13: Organic Hydroponics	
April 19	Module 14: Food Safety Certification	HW 7: VPD,Lighting, Organics

April 26	Module 15: Mushroom Production	
May 3	Module 16: Troubleshooting Activity 2 or Class choice	HW 8: Mushrooms
<b>Tuesday May 11</b>	<b>FINAL EXAM</b>	