

SYLLABUS

INTRODUCTION TO CONTROLLED ENVIRONMENT AGRICULTURE

ABEN 286, 3 credits, Fall 2023

Instructors:

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Department: Agricultural & Biosystems Engineering (ABEN)

Class time/location: TTH 3:30 – 4:45 pm lectures at Ladd Hall 114

Office hours: TTH 1:00 – 2:00 pm, or by appointment

COURSE DESCRIPTION: General principles and applications of controlled environment agriculture (CEA), including hydroponic, aeroponic, aquaponic, vertical farming, irrigation, high tunnel, low tunnel, mulches, and their management factors, such as lighting, heating, ventilation, media, nutrient, pest and smart technology.

PREREQUISITE: Math 103.

ABEN EDUCATIONAL OBJECTIVES AND ABET STUDENT OUTCOMES

A. Successfully address emerging engineering challenges in the design or evaluation of machine systems, processing systems, and natural resources and environmental systems affecting the production of food, feed, and other biobased products.

Technical learning outcomes include student outcomes (1), (2), and (6):

(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

B. Effectively use professional communication, critical thinking, and interpersonal skills as team leaders and team members.

Communicational learning outcomes include student outcomes (3) and (5):

(3) an ability to communicate effectively with a range of audiences.

(5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

COURSE OBJECTIVES

After completing this class, students should be able to:

- Understand the general principles and applications of CEA [ABET -A(1), A(2) & A(6)].

- Demonstrate a basic understanding of different CEA systems for plant production [ABET-A(1), A(2) & A(6)]
- Know how to manage the CEA through proper environmental controls [ABET-B(3) & B(5)]

TEXTBOOKS (Optional):

1. Resh, H.M. 2013. *Hydroponic Food Production: A Definitive Guidebook for the Advanced Home Gardener and the Commercial Grower*, 7th Ed., CRC Press Taylor & Francis Group, Boca Raton, FL, USA.
2. Kozai, T., G. Niu, and M. Takagaki. 2020. *Plant Factory: An Indoor Vertical Farming System for Efficient Quality Food Production*, 2nd Ed., Academic Press, Elsevier Inc., Cambridge, MA, USA.
3. Dawling, P. 2019. *The Year-Round Hoophouse: Polytunnels for All Seasons and All Climates*. New Society Publishers, Gabriola Island, British Columbia, Canada.

STUDENT RESOURCES: Additional reading materials, lecture outlines, and your grades will be posted on Blackboard. You are responsible for checking the course Blackboard regularly and downloading/printing the materials on time.

EVALUATION PROCEDURES AND CRITERION

Evaluation	Points
Quizzes	100
Project	100
Exam 1	100
Exam 2	100
Final exam	100
Total	500

Grade	Points
A	450 - 500
B	400 – 449
C	350 – 399
D	300 – 349
F	< 300

Grading Policies

1. Quizzes will be randomly given to assess student’s understanding of the course materials, course assessment, and check of your attendance during the lecture time. There will be NO makeup quizzes under any circumstances, but two lowest quizzes will be dropped from your total score.
2. Missed exams will receive ZERO point unless it is due to a medical or family emergency. You are required to notify the instructor in advance. Documented proof from an authorized person is required. A makeup exam will be scheduled between the instructor and the student.
3. A group project that is related to one type of CEA systems will be selected by the students at the beginning of the semester. The students are expected to work on the project throughout the semester. Monthly progress reports, a final group presentation and a final project report are required and graded. Detailed instructions, grading criterion, and due time will be given later in the class.

Other Policies

1. If you are falling behind in the course or have any questions about the course, please see the instructor or email the instructor about your concern as soon as possible.
2. When you contact the instructor through emailing, please use your official NDSU email and put “ABEN 286” in the subject line of the email. This will ensure that your email be responded to as a priority and your message doesn’t fall into the Junk E-Mail folder.

ATTENDANCE POLICY AND COVID-19 ACCOMMODATION

In accordance with NDSU Policy 333 (<http://www.ndsu.edu/fileadmin/policy/333.pdf>), class participation is expected at all regularly scheduled class and lab times as they are critical to every student’s success in this course. Although students are expected to participate in the course face-to-face (see below for face covering policy), when needed, students are also able to participate virtually in synchronous or asynchronous discussions and activities. Students are expected to attend every class and remain in class for the duration of the session.

If you are unable to attend class at the regularly scheduled time due to illness, contact the instructor for alternate arrangements, including recordings of class sessions and assignments as well as accommodations and extensions as needed. **Do not come to class if you are sick.** Please protect your health and the health of others by staying home and participate in class remotely.

ACADEMIC HONESTY

The academic community is operated on the basis of honesty, integrity, and fair play. [NDSU Policy 335: Code of Academic Responsibility and Conduct](#) applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the [Office of Registration and Records](#). Informational resources about academic honesty for students and instructional staff members can be found at www.ndsu.edu/academichonesty.

Students with special requirements: Any students with disabilities or other special needs, who need special accommodations in this course are invited to share these concerns or requests with the instructor as soon as possible. The instructor may ask for verification and that, plus other assistance, can be requested from Disability Services in the Lower Level of the NDSU Library (231-8463). <http://www.ndsu.edu/disabilityservices/>.

Veterans and military personnel: Veterans or military personnel with special circumstances or who are activated are encouraged to notify the instructor as early as possible.

STUDENTS WITH SPECIAL REQUIREMENTS

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IMPORTANT DATES

<i>August 21</i>	<i>Classes begin at 4:00 pm</i>
<i>August 22</i>	<i>First full day of classes</i>
<i>August 30</i>	<i>Last day to add classes via Campus Connection</i>
<i>August 30</i>	<i>Last day for no-record drop of classes @ 100% refund</i>
<i>August 30</i>	<i>Last day to withdraw to 0 credits @ 100% refund</i>
<i>September 4</i>	<i>Labor Day holiday (no classes/offices closed)</i>
<i>September 5</i>	<i>Financial Aid applied to Student Accounts</i>
<i>September 11</i>	<i>Last day to submit request to audit, pass/fail</i>
<i>October 16</i>	<i>Undergraduate fall graduation application due</i>
<i>October 16</i>	<i>Graduate student Intent to Graduate due</i>
<i>October 16</i>	<i>Grades of Incomplete convert to F</i>
<i>October 26</i>	<i>Spring/ Summer registration begins</i>
<i>November 9</i>	<i>Last day to drop classes with 'W' record</i>
<i>November 9</i>	<i>Last day to <u>withdraw to zero credits</u> for Fall</i>
<i>November 10</i>	<i>Veteran's Day (no classes/offices closed)</i>
<i>November 17</i>	<i>Fall commencement participation deadline</i>
<i>November 22-24</i>	<i>Thanksgiving no classes (offices open on Friday)</i>
<i>December 4-8</i>	<i>Dead Week</i>
<i>December 11-15</i>	<i>Final Examinations</i>
<i>December 15</i>	<i>Commencement</i>

**TENTATIVE LECTURE SCHEDULE
INTRODUCITON TO CONTROLLED ENVIRONMENT AGRICULTURE**

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Date	Topics
8/22	Introduction (Pretest)
8/24	Introduction to CEA
8/29	Field Tour at West Fargo
8/31	Growing media (Textbook #1)
9/5	Hydroponics (Textbook #1) – assign group projects
9/7	Hydroponics (Textbook #1)
9/12	Hydroponics (Textbook #1)
9/14	Aeroponics (Textbook #1)
9/19	Aeroponics (Textbook #1)
9/21	Vertical Farming (Textbook #1)
9/26	Microgreen
9/28	Sprouting
10/3	Review and catch up
10/5	Exam 1
10/10	Nutrients (Textbook #1)
10/12	Nutrients (Textbook #1)
10/17	Irrigation (Textbook #1)
10/19	Irrigation (Textbook #1)
10/24	Lights (Textbook #2)
10/26	Environmental factors (Textbook #2)
10/31	Field Tour at Detroit Lake
11/2	Pests (Textbook #2)
11/7	Smart CEA (Textbook #2)
11/9	Research in CEA (Textbook #2)
11/14	Exam 2
11/16	High tunnels (Textbook #3)
11/21	High tunnels (Textbook #3)
11/28	Low tunnels (Textbook #3)
11/30	Mulches (Instructor notes)
12/5	Mulches (Instructor notes)
12/7	Group presentation
12/14	Final exam at 3:30 – 5:30 pm