

# ABEN 452/652 – Bioenvironmental Systems Design – Fall 2022

## **BASIC INFORMATION**

### **Class information:**

3 Credits  
Fall 2022  
Classroom: ABEN RM 201  
Time: 10:00AM - 10:50AM; MWF

### **Instructor information:**

Dr. Iris Feng  
Office: ABEN 106  
Phone: 701-231-8351  
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**Textbook:** Agricultural Buildings and Structures—by Lindley, James A., and James H. Whitaker.

### **Recommended materials:**

- Environment Control for Animals and Plants—by Louis D. Albright
- Midwest Plan Service (MWPS) Standards:
- Structures and Environment Handbook, Mechanical and Natural Ventilation Packages (MWPS 32 & 33), Manure Storages (MWPS 18-S2), Outdoor Air Quality (Livestock Manure) Manure Management System Series (MWPS 18-S3), etc.
- Others as found appropriate.

**Prerequisites:** ABEN 263 or CE309 or ME 350

**Office hours:** 11:00 – 12:00 a.m. MWF; or by appointment or drop in.

**Web pages:** Blackboard

## **COURSE DESCRIPTION**

ABEN 452/652 Bioenvironmental Systems Design covers fundamental principles of environmental control in agriculture and general design criteria of typical agricultural facilities. The students will learn how to control and maintain ideal bioenvironmental parameters such as temperature, moisture, ventilation rates, and lighting in agricultural building constructions under different conditions.

## **ABEN EDUCATIONAL OBJECTIVES AND ABET STUDENT OUTCOMES**

The Accreditation Board for Engineering and Technology (ABET) requires that accredited engineering programs publish their program educational objectives (PEOs) and student outcomes (SOs). A goal of this course is to meet ABET requirements. The ABET criteria developed for this course are listed below:

ABEN program educational objectives and supporting student outcomes.\*

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Graduates are expected to have established themselves as practicing engineers who, within a few years of graduation:

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- 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):

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

ABET-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

ABET-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):

ABET-3. an ability to communicate effectively with a range of audiences

ABET-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

- C Responsibly serve the public and their employers by participating in professional development and by maintaining the highest standard of professional engineering ethics.

Contextual learning outcomes include student outcomes (4) and (7):

ABET-4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

ABET-7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

\* See [https://www.ndsu.edu/aben/about/abet\\_accredited/](https://www.ndsu.edu/aben/about/abet_accredited/) for the current ABEN program educational objectives. See <https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-engineering-programs-2019-2020/#GC3> for information on ABET student outcomes 1-7, effective as part of the "Criteria for Accrediting Engineering Programs, 2019-2020."

## **COURSE OBJECTIVES**

After completing this course, students should:

1. Have a basic understanding of heat and mass transfer and psychometrics. (ABET-1)
2. Be familiar with typical bioenvironmental systems in agriculture. (ABET-1)
3. Understand properties and characteristics of insulating materials, cooling and heating systems, ventilation systems, feeding operations, etc. (ABET-1)
4. Be able to calculate and determine required control parameters to meet the animal and plant needs. (ABET-2)
5. Understand the design criteria of livestock buildings, greenhouses, waste treatment, farmstead, and product storage. (ABET-6)
6. In addition to all of the above, graduate students will be required to write a term paper and do a presentation in the classroom. (ABET-3&4)

## **EVALUATION PROCEDURES AND GRADING CRITERIA**

**Assignment Policy:** Due dates for the homework and the term paper will be given with the assignments. Late assignments will be accepted with a 10% penalty per NDSU class day. Assignments must be submitted via paper copies, via e-mail, and/or via Blackboard before the announced due dates to be credited to the day it is received. If any homework, quizzes, tests, etc. are submitted electronically and require printing by the instructor, please note that points will be deducted if the instructor cannot open your file and print your work "as is," i.e., no adjustments for print areas, scaling, etc. Late assignments will not be accepted after solutions are posted/handed out/discussed or after 3 NDSU class days from the date they are due.

**Exam Policy:** Missed quizzes and exams will receive zero points unless missed for a valid justification and the instructor is notified prior to the date and time of the quiz or exam. Valid justification is a statement indicating illness, obituary notice (death in family or loved one), or co-curricular activities. For such justified reasons, a make-up exam may be given at a mutually acceptable time or the weight of the missed mid-term exam will be shifted to the final exam. Extracurricular activities, weddings, vacations, hunting and fishing trips, work, dentist's appointments, and undocumented car-related incidents are examples of unjustifiable reasons for missing the scheduled dates and times for exams. The instructor reserves the right to determine whether the excuse is legitimate or not.

**Grading Policy:** All students (undergraduate and graduate) will have to complete the following four categories of work in this course: homework assignments, quizzes, midterm exams, and one comprehensive final exam. Graduate students will be required to write an engineering report of designing a bioenvironmental system in addition to the above course work. The report will be subject to approval from the instructor to ensure appropriate scope and content. The total of the possible points which can be earned for a student is 100 (100%). The grading procedure planned for the course is as follows:

Grade components for ABEN 452/652		
Category	Undergraduate	Graduate
Homework	10%	10%
Quizzes	10%	10%
Midterm 1	20%	15%
Midterm 2	20%	15%
Project	N/A	15%
Final exam	40%	35%
Total	100%	100%

Each student's final letter grade in the course will be determined by the percentage of the total earned points over the total possible points using the following grading scale:

$90\% \leq A \leq 100\%$
$80\% \leq B < 90\%$
$70\% \leq C < 80\%$
$60\% \leq D < 70\%$
$0\% \leq F < 60\%$

### **TENTATIVE COURSE SCHEDULE / OUTLINE / CALENDAR OF EVENTS**

2022 Fall, ABEN 452/652 8/24/2022-12/16/2022

22-Aug	Mon	
24-Aug	Wed	First day of class-Introduction to ABEN 452/652 and syllabus
26-Aug	Fri	Heat and mass transfer
29-Aug	Mon	
31-Aug	Wed	Psychrometrics
2-Sep	Fri	
5-Sep	Mon	HOLIDAY — Labor Day (no classes, offices closed)
7-Sep	Wed	Psychrometrics
9-Sep	Fri	
12-Sep	Mon	Loads
14-Sep	Wed	
16-Sep	Fri	Insulation & Vapor barriers
19-Sep	Mon	Heat & Moisture balance
21-Sep	Wed	
23-Sep	Fri	Ventilation systems
26-Sep	Mon	

28-Sep	Wed	
30-Sep	Fri	
3-Oct	Mon	Livestock housing-swine
5-Oct	Wed	
7-Oct	Fri	Livestock housing-beef, sheep
10-Oct	Mon	<i>Field trip 1: Livestock buildings--swine</i>
12-Oct	Wed	Livestock housing-dairy
14-Oct	Fri	<b>Midterm 1</b>
17-Oct	Mon	Greenhouses
19-Oct	Wed	
21-Oct	Fri	
24-Oct	Mon	Storage
26-Oct	Wed	
28-Oct	Fri	
31-Oct	Mon	
2-Nov	Wed	Storage
4-Nov	Fri	Livestock housing
7-Nov	Mon	
9-Nov	Wed	<i>Guest speaker 1: Post-harvest crop storage by Dr. Kenneth Hellevang</i>
11-Nov	Fri	HOLIDAY — Veterans Day (no classes, offices closed)
14-Nov	Mon	Livestock housing
16-Nov	Wed	Ag waste treatment
18-Nov	Fri	<b>Midterm 2</b>
21-Nov	Mon	<i>Field trip 3: Livestock buildings--cattle</i>
23-Nov	Wed	HOLIDAY — Thanksgiving (no classes; offices closed Thursday, offices open Wednesday & Friday)
25-Nov	Fri	
28-Nov	Mon	<i>Guest speaker 2: Modern livestock by Lyle Grimm</i>
30-Nov	Wed	Ag waste treatment
2-Dec	Fri	
5-Dec	Mon	
7-Dec	Wed	Dead Week <i>Guest speaker 3: Compost &amp; waste management by Mary Keena</i>
9-Dec	Fri	Dead Week Project presentation
12-Dec	Mon	<b>Final Examinations</b>
14-Dec	Wed	
16-Dec	Fri	

### **ATTENDANCE**

According to [NDSU Policy 333 \(www.ndsu.edu/fileadmin/policy/333.pdf\)](http://www.ndsu.edu/fileadmin/policy/333.pdf), attendance in classes is expected. Attendance is not required for this class but you are responsible for all materials, discussion, and other items presented in class as well as all scheduling changes discussed in class. If you miss class, the instructor will provide handouts upon your return if asked; you are responsible for obtaining notes from a classmate.

Veterans and student service members with special circumstances or who are activated are encouraged to notify the instructor as soon as possible and are encouraged to provide Activation Orders.

### **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](http://www.ndsu.edu/academichonesty).

In this class, you may consult with a classmate on procedures for homework designated as requiring individual work, but the final product must be your original work. Homework, reports, or projects which involves team effort, will be designated as such and the following policies apply. The team will typically submit one set of papers for grading. Sharing of the workload, calculations, reporting, etc. is acceptable and expected. It is expected that all participants will have access to copies of the material and that all participants will contribute toward completion of the final product. Sharing of material between teams is not acceptable; the policy above for individual work also applies to interactions between teams.

Quizzes, tests, and the final exam will require individual work with no help from anyone in any form or by any means.

### **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 and contact the Disability Services Office (<http://www.ndsu.edu/disabilityservices/>) 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).

### **IMPORTANT DATES**

August 31	Last day to add classes via Campus Connection
August 31	Last day for no-record drop of classes @ 100% refund
August 31	Last day to withdraw to 0 credits @ 100% refund
September 5	Labor Day holiday (no classes/offices closed)
September 6	Financial Aid applied to Student Accounts
September 12	Last day to submit request to audit, pass/fail
October 14	Undergraduate fall graduation application due
October 14	Graduate student Intent to Graduate due
October 14	Grades of Incomplete convert to F
October 27	Spring/ Summer registration begins
November 11	Veteran's Day (no classes/offices closed)
November 10	Last day to drop classes with 'W' record
November 10	Last day to <a href="#">withdraw to zero credits</a> for Fall
November 18	Fall commencement participation deadline
November 23-25	Thanksgiving no classes (offices open on Friday)
December 5-9	Dead Week
December 12-16	Final Examinations

December 16      Commencement

**HEALTH AND SAFETY EXPECTATIONS**

Masks are not required in this class, but if you are experiencing COVID-19 symptoms or tested positive, I ask that you wear a mask to help protect my health and the health of your peers. Where possible, please spread out within the classroom, including not sitting in the first row of the classroom, to maximize social distancing.

**ATTENDANCE EXPECTATIONS**

If you do not come to class due to the COVID-19 (feeling ill, experiencing COVID-19 symptoms, or being infected during your five-day isolation period), you will still need to complete the assignments, exams, reading, etc. necessary to meet class learning objectives. The instructor will work with you to make up the material. Please let the instructor know as soon as possible, and in advance if possible, if you will miss a class session due to illness.