

**The University of Manitoba
Faculty of Agricultural and Food Sciences**



Course Title: Agricultural Buildings and Environments

Department: Biosystems Engineering

Course Number: BIOE 0700

Academic Session: Winter 2023

Credit Hours: 4

Prerequisites and how they apply to this course: None

Classroom Location: E2 304

Meeting Days and Class Hours: MWF 11:30 -12:20

Lab Location: E2 304

Lab Hours: M 2:30 -3:20

Department Office location: E2-376 EITC

Phone Number: 204-474-6033

Instructor Information

Name & Title: Derek Inglis.

Email Address: Derek.Inglis@umanitoba.ca

Office Location: A206 Agricultural Engineering Building **Office Phone:** 204-474-7964 or 204-470-5290

Office Hours: Flexible. You may contact me by phone, email, or WebEx. Emails sent after business hours will not likely be answered until the next day.

Teaching Assistant(s) (if applicable):

TA Office Hours and Location:

Course Philosophy

Students' Learning Responsibilities

Learning is most effective when both the teacher and the student are engaged in the subject material. The role of the teacher is to create an environment that facilitates students' engagement and learning. Students are expected to attend classes and labs, participate in class discussions, complete assignments, and write tests and the final examination with academic integrity and honesty. Students are encouraged to suggest topics for discussion where the situation or problem is related to the subject matter of the lectures.

Why this course is useful?

Digital technologies are playing a more and more important role in agriculture. This course covers precision livestock farming (PLF), which focuses on the application of digital technologies in livestock farming. This course will provide students with basic knowledge of digital technologies and students will acquire the knowledge and skill sets of selecting and using digital technologies in livestock farming.

Who should take this course?

This course is of value to a wide range of students from those who wish to work in the livestock sector to those who need to interact with the livestock producers.

Course Description/Objectives

Undergraduate Calendar Description

Factors that impact the practicality of farm buildings. Components of buildings, including materials and construction techniques. Techniques of maintaining building environments to facilitate production and/or storage.

Instructional Methods

Lectures with in-class discussion. Technologies, computer simulation, data collection and analysis will be demonstrated and/or explained through videos. Students will demonstrate their grasp of PLF knowledge by hands-on analysis and lab reports.

Course Objectives

The course objectives are to assist/facilitate students to:

- understand the concept, principle, and benefits of PLF;
- understand the principles of sensing for information collection in PLF;
- gain the knowledge of sensors commonly used in PLF;
- understand the principles of information analysis and integration in PLF;
- become familiar with PLF technologies available for various livestock operations;
- gain knowledge and skills of selecting and using PLF technologies; and
- understand the impact of PLF on livestock farming

Learning outcomes

After completing the course, students should be able to identify the knowledge, skills, attitudes, and personal attributes expected of them to successfully complete their program of studies. The specific learning outcomes include:

- understanding how PLF can improve the efficiency and reduce the environmental impact in livestock farming;
- understanding how the digital technologies in PFL are used to optimize the environment for animals;
- understanding how the digital technologies in PFL are used to improve animal health and welfare, as well as the product quality;
- understanding how the digital technologies in PFL can reduce the labour requirements in livestock operations;
- identifying the key technological elements in PLF;
- understanding how smart sensors work in PLF;
- understanding how multiple sensor data is integrated (fused);
- understanding sensor networking (IoT); and
- knowing the current technologies of PLF available for various types of livestock operations.

Grade Evaluation

Mid-term test	20%
Lab reports and assignments	20%
Group project	20%
Final Examination	40%

Grading

Letter Grade	Percentage out of 100
A+	92-100
A	85-91
B+	78-84
B	72-77
C+	66-71
C	60-65
D	50-59
F	Less than 50

Important Dates

Mid-term test February 16, 2023

Voluntary withdrawal date March 22, 2023

Final examination (to be scheduled)

Texts, Readings, Materials

Textbook(s) – Authors, Titles, Edition

None

Supplementary Reading

Precision Livestock Farming Applications, edited by Ilan Halachmi, Wageningen Academic Publishers,

<https://doi.org/10.3920/978-90-8686-815-5>.

Course Policies

Late Assignments

Late submission of assignments (including lab reports) will be accepted up to 7 days (including weekends and holidays) following the due date. Each late day after the due date will result in 10% reduction of the marks for each individual assignment. Assignments submitted after 7 days will have no credit.

Missed Assignments

Will receive a zero grade.

Missed Exams

There is NO make-up examination for a missed mid-term! If missed and student has a valid medical certificate or compassionate reason (e.g., death of an immediate family member), marks from the mid-term will be added to marks for the final examination. Students who miss the examination without a valid reason will receive a grade of zero (0) for the mid-term.

In the case of a missed final examination, a student will be assigned an F No Paper grade for the course unless an acceptable medical certificate or a confirmable compassionate reason is provided in which case a supplementary examination will be allowed.

Academic Integrity

Plagiarism or any other form of cheating in examinations, term tests or academic work is subject to serious academic penalty. Cheating in examinations or tests may take the form of copying from another student or bringing unauthorized materials into the exam room. Exam cheating can also include exam impersonation. A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty. Students should acquaint themselves with the University's policy on plagiarism, cheating, exam impersonation and duplicate submission (see section in the University of Manitoba Undergraduate Calendar 2022/2023).

Use of Third Party Detection and Submission Tools

Electronic detection tools may be used to screen assignments in cases of suspected plagiarism.

Group Work Policies

Students are allowed to discuss assignments and labs with each other, but the individual assignments and reports must be independently written. Copying or joint production of assignments and reports will result in all involved students receiving zero marks.

Course Content

1. Introduction
 - 1.1. Challenges in livestock farming
 - 1.2. Digital technologies
2. Concept and framework of precision livestock farming (PLF)
 - 2.1. Framework of PLF
 - 2.2. Added values of PLF to farmers
 - 2.3. Adaptation of PLF by farmers
3. PLF Technologies - sensing and sensors
 - 3.1. Environmental sensing
 - 3.1.1. Defining the environment – what to be sensed?
 - 3.1.2. Sensing physical variables of environment
 - 3.1.3. Integration of sensed physical parameters of environment with animal responses
 - 3.1.4. Sensing disease pathogens in environment
 - 3.2. Animal behavior sensing
 - 3.2.1. Imaging technologies
 - 3.2.2. Motion sensing
 - 3.2.3. Feeding management
 - 3.2.4. Remote sensing for grazing herds
 - 3.3. Animal health sensing
 - 3.3.1. Disease detection
 - 3.3.2. Welfare monitoring
 - 3.4. Animal product sensing
 - 3.4.1. Product quality and safety
 - 3.4.2. Animal health
 - 3.5. Types of sensors in PLF
 - 3.6. Sensor networks, IoT, and cloud computing
4. PLF Technologies – software
 - 4.1. Data fusion
 - 4.2. Pattern recognition
 - 4.3. Big data
 - 4.4. Statistical analysis
 - 4.5. Model-based or prediction-based control of processes
5. PLF technologies for specific livestock operations
 - 5.1. Dairy
 - 5.2. Swine

5.3. Poultry

5.4. Beef cattle (and other grazing animals)

5.5. Other animals

Labs:

1. Group project
2. Environmental control for confinement livestock housing (videos)
3. Virtual tour of livestock facilities at Glenlea Research Station (videos)
4. Virtual tour of commercial livestock facilities (videos)
5. Accelerometer for motion sensing
6. Sound analysis
7. Image analysis: sow body condition scoring
8. Electronic sow feeder (ESF)
9. Robotic milking system