



## Course Outline

### Instructor

- Dr. Jiating Li  
E1-342 EITC  
204-474-8429  
[Jiating.Li@umanitoba.ca](mailto:Jiating.Li@umanitoba.ca)

### Student Hours

- Individual assistance is available by appointment.

### Teaching Assistant

- N/A

### Location

- **E1-342 EITC**  
Mon 11:00 – 12:15 PM  
Weds 11:00 – 12:15 PM

### Contact Hours

- 3 credit hours
- Lectures:  
3 hours x 12 weeks = 36 hours

### Prerequisites:

- Registered in the Biosystems Engineering program.

### Course Website:

<http://umanitoba.ca/umlearn>

## Traditional Territories Acknowledgement

The University of Manitoba campuses are located on the original lands of Anishinaabeg, Ininiwak, Anisininewuk, Dakota Oyate and Dene, and on the National Homeland of the Red River Métis.

We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of reconciliation and collaboration.

## BIOE 7240 Digital sensing and data analytics for smart crop production

Winter 2026

### Course Description

Advances in agricultural automation, sensors, and AI have revolutionized the way farming is done. This course will introduce graduate students to the fundamental digital technologies that enable smart crop production systems. Students will learn the principles of data acquisition systems, sensors, and analytical methods in digital agriculture.

### Learning Objectives

By the end of the course, students will be able to:

1. Explain the working principles and limitations of major sensors used for crop, soil, and environmental monitoring.
2. Compare and evaluate different data acquisition systems across ground, proximal, and aerial sensing platforms.
3. Process and analyze drone-based optical imagery to extract key variables such as vegetation indices that indicate crop health.
4. Build and interpret basic machine learning models to predict crop traits using different types of sensing data.
5. Develop both written and oral scientific presentation skills through projects.

### Class Schedule

|                 |                                     |
|-----------------|-------------------------------------|
| <b>Week 1:</b>  | Introduction                        |
| <b>Week 2:</b>  | Sensors and sensing methods         |
| <b>Week 3:</b>  | Sensors and sensing methods         |
| <b>Week 4:</b>  | Data acquisition platforms          |
| <b>Week 5:</b>  | Data acquisition platforms          |
| <b>Week 6:</b>  | Data acquisition platforms          |
| <b>Week 7:</b>  | Data analytics and machine learning |
| <b>Week 8:</b>  | Data analytics and machine learning |
| <b>Week 9:</b>  | Data analytics and machine learning |
| <b>Week 10:</b> | Integrated modeling                 |
| <b>Week 11:</b> | Integrated modeling                 |
| <b>Week 12:</b> | Students' presentations             |
| <b>Week 13:</b> | Course wrap-up                      |

### Course Materials

Recommended textbook (Access provided by University of Manitoba Libraries):

1. Digital Agriculture (Editors: Daniel Marçal de Queiroz, Domingos Sárvio M. Valente, Francisco de Assis de Carvalho Pinto, Aluizio Borém, John K. Schueller, 2022)
2. Encyclopedia of Digital Agricultural Technologies (Editors: Qin Zhang, 2023)

Lecture notes and additional reading materials for each topic will be announced in class and posted on UM Learn.

## Important Dates

- **Early Withdrawal Deadline**  
January 19, 2026
- **Winter Term Break**  
February 16-20, 2026  
No classes or examinations
- **Voluntary Withdrawal Deadline**  
March 19, 2026
- **Last Day of Classes**  
April 9, 2026

## Grading Scale

| 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          |

## Assignment Feedback

Students can expect to receive graded assignments within two weeks of their submission.

## Late Submission Policy

Assignments submitted after the due date will be docked 10% per day.

## Referencing Style

Students are expected to follow the citation style that is used by the *Canadian Biosystems Engineering* journal when citing references in course assignments.

## Evaluation

| Assignment                     | Allocation | Description  | Due Date       |
|--------------------------------|------------|--|----------------|
| Attendance                     | 5%         |  |                |
| Weekly self-reflection         | 5%         | Students will be asked to provide a weekly self-reflection (maximum 100 words) on their progress and feedback on courses.  | Weekly         |
| Project and final presentation | 30%        | Each student will complete an individual final project that integrates course concepts in sensing, data processing, and data analytics for smart crop production systems. The project is an opportunity to work with real agricultural datasets and develop your own research question, analysis pipeline, and scientific communication skills. Students will make a final presentation to report on their project. The instructor will provide potential project topics for students to choose. | TBD            |
| A mini literature review       | 30%        | Students are expected to conduct a mini literature review for their selected project. Students will collect 10-15 relevant papers, then the instructor will assess the relevance of these papers. Once the papers are approved by the instructor, students will write a mini literature review to highlight current research status, identify the research gap, and propose potential solutions for the selected project topic.  | March. 1, 2026 |
| Final scientific report        | 30%        | A final written report detailing the methodologies, results, discussions, and conclusion of the project is required.   | April. 9, 2026 |

## Academic Integrity and Generative Artificial Intelligence (genAI)

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the *General Academic Regulations on Academic Integrity*, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.

The use of generative artificial intelligence (genAI) tools and apps is strictly prohibited in all course assignments unless explicitly stated otherwise by the instructor in this course. This includes ChatGPT and other AI writing and coding assistants. Use of genAI in this course may be considered use of an unauthorized aid, which is a form of cheating.

## Requirements/Regulations

- Please copy the Instruction Team in all emails (Instructors and Teaching Assistants). All email communication must conform to the Communicating with Students university policy.

 [Communicating with Students](#)

- As the Instruction Team, we will do our best to respond to all emails **within 48 hours during working hours** (8:30 AM – 5:30 PM Monday thru Friday). Ex. A Friday night email may not be responded to until the following Tuesday.
- Self-declaration forms may be completed for missed tests, exams, or assignments during short-term absences ( $\leq 72$  hours) for extenuating circumstances. This form cannot be used for planned absences like vacations. It is also not to be used for longer-term absences, or ongoing circumstances (e.g., Authorized Withdrawals, Leaves of Absence, or other accommodations), which will still require additional documentation.
  - [Self-Declaration Form for Brief or Temporary Absence](#)
  - [Self-Declaration Policy for Brief or Temporary Absences](#)
- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should familiarize themselves with the University's *General Academic Regulations*.
  - [General Academic Regulations](#)
  - [Engineering Academic Regulations](#)
- Students should be aware that they have access to an extensive range of resources and support organizations. These include Academic Resources, Counselling, Advocacy and Accessibility Offices as well as documentation of key University policies e.g., Academic Integrity, Respectful Behaviour, Examinations, and related matters.
  - [Supplemental Resources](#)

## Retention of Student Work

Students are advised that copies of their work submitted in completing course requirements (i.e. assignments, laboratory reports, project reports, test papers, examination papers, etc.) may be retained by the instructor and/or the department for the purpose of student assessment and grading. This material shall be handled in accordance with the University's *Intellectual Property Policy* and the protection of privacy provisions of *The Freedom of Information and Protection of Privacy Act (Manitoba)*. Students who do not wish to have their work retained must inform the Head of Department, in writing, at their earliest opportunity.

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