ANSC*4040 - Digital Technologies for Animal Production Systems

Fall 2025 Course Outline
Section: 01
Credits: 0.50

Land Acknowledgement: Guelph

The University of Guelph resides on the ancestral lands of the Attawandaron people and the treaty lands and territory of the Mississaugas of the Credit. We recognize the significance of the Dish with One Spoon Covenant to this land and offer respect to our Anishinaabe, Haudenosaunee and Métis neighbours. Today, this gathering place is home to many First Nations, Inuit, and Métis peoples and acknowledging them reminds us of our important connection to this land where we work and learn.

Calendar Description

Major topics and methods which fall within the scope of 'digital animal production' will be covered. Broad areas of focus include feed formulation, animal models and the application of machine learning within animal production systems.
Prerequisite(s): ANSC*3120, STAT*2040
Restriction(s): Registration in BSAG or BSCH.ABIO
Department(s): Department of Animal Biosciences

Course Description

Globally, animal production systems are rapidly digitalizing, capturing large volumes of data automatically, increasingly utilizing sensors to monitor individual animals, using machine learning algorithms to interpret sensor data and relying on complex computational/modelling systems for decision-making and problem solving on farm. This technical leap forward in animal production systems requires a strong data/computational skill-set in our graduates. Therefore, this course will introduce students to major topics and methods that fall within the scope of ‘digital animal production’. Topics include data management and manipulation, predictive growth curves, feed formulation, and animal models, as well as introduce students to concepts in machine learning, sensors and precision nutrition as applied on farm. Students should leave the course with solid computational skills and an understanding of the application of digital tools (ie. sensors, models, etc.) used in animal production systems. Students will be evaluated via regular assignments and a written research proposal.

Lecture Schedule

MonWedFri 8:30am-9:20am in ANNU*030 (9/4 to 12/12)

Lab / Seminar Sections

Day	Time	Location
Friday	2:30-5:20 pm	ANNU room 102

Instructor Information

Jennifer Ellis, PhD
Associate Professor, Animal Systems Modelling
Email: jellis@uoguelph.ca
Office: ANNU 234b

Learning Resources

The instructor and guests will lecture in person in an interactive discussion-based manner, provide feedback to students on assignments, oversee/prepare applied learning exercises and mark assignments. Copies of the lectures will be provided as PDFs via CourseLink.

Required Resources

Course Website (Website)

Course material, news, announcements, and grades will be regularly posted to the ANSC*4040 CourseLink site. You are responsible for checking the site regularly.

Course Materials (Other)

Course notes will be used during the course (available in the course's webpage). Additional, pertinent information, such as papers, chapters of books, etc. will be accordingly recommended and placed on the course's webpage. Students are advised to take their own notes during lectures.

Campus Resources

If you are concerned about any aspect of your academic program: Make an appointment with a Program Counsellor (https://www.uoguelph.ca/uaic/programcounsellors/) in your degree program. If you are struggling to succeed academically: There are numerous academic resources offered by the Learning Commons (https://www.lib.uoguelph.ca/using-library/spaces/learning-commons/) including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills.

Cost of Textbooks and Learning Resources

Textbook / Learning Resource	Required / Recommended	Cost
NA	NA	$0

Students are advised that prices are often determined by the publisher or bookstore and may be subject to change.

Field Trip Fees

For those courses in the Department of Animal Biosciences that have a field trip component - an associated fee for each field trip in the amount of $20 will apply. Further details on how these fees will be collected will be provided in class/on CourseLink; along with a waiver form that will need to be completed prior to the trip(s).

Course Learning Outcomes

1. Perform basic data manipulations common in animal science.
2. Troubleshoot data calculation and coding problems.
3. Apply statistical and computational methodologies to gain insight from real animal data.
4. Interpret and judge the biological significance of mathematical equations & code
5. Explain and discuss new and emerging digital tools, applications and developments in animal production.
6. Communicate scientific content in numerical, written and oral form accurately and effectively.
7. Use terminology common in digital animal production proficiently.

Schedule of Topics and Assignments

Day	Date:	Topic	Activities	Due
Fri	9/5	Course Introduction LAB - (no Lab)	Lecture 1 LAB 1	
Mon	9/8	Introduction - Digital Animal Production (recorded)	Lecture 2	
Wed	9/10	Introduction (2) - Digital Animal Production (recorded)	Lecture 3	
Fri	9/12	(no lecture) LAB - Basic nutrient calculations - review (Guest Lecture)	Lecture 4 LAB 2	
Mon	9/15	Principles of feed formulation (1)	Lecture 5	
Wed	9/17	Principles of feed formulation (2)	Lecture 6	

Fri	9/19	Principles of feed formulation (3) LAB - Feed formulation probelm	Lecture 7 LAB 3	
Mon	9/22	Principles of feed formulation (4)	Lecture 8	
Wed	9/24	Introduction to NIRS	Lecture 9	
Fri	9/26	Drop in/Office hours LAB - Guest Speaker - NIRS/in-line NIRS	Lecture 10 LAB 4	
Mon	9/29	Intro to coding in Python (basic python)	Lecture 11	Assignment 1 Due
Wed	10/1	Intro to coding in Python (data manipulation)	Lecture 12	
Fri	10/3	Intro to coding in Python (data visualization) LAB - Coding in Python	Lecture 13 LAB 5	
Mon	10/6	Animal growth and production curves	Lecture 14	
Wed	10/8	Requirement curves and feed degradation kinetic curves	Lecture 15	
Fri	10/10	Model Evaluation LAB - Curve fitting (coding)	Lecture 16 LAB 6	
Mon	10/13	Thanksgiving Holiday		
Wed	10/15	Empirical modelling - meta-analysis	Lecture 17	
Fri	10/17	Guest Speaker - Body composition (CT scans & deep learning) LAB - Guest Speaker - Industry Application	Lecture 18 LAB 7	
Mon	10/20	Requirement models	Lecture 19	Assignment 2 Due
Wed	10/22	Mechanistic models	Lecture 20	
Fri	10/24	Mechanistic models LAB - Mechanistic models	Lecture 21 LAB 8	
Mon	10/27	Whole Farm Models	Lecture 22	
Wed	10/29	Life Cycle Analysis (LCAs), Sensor Technology	Lecture 23	
Fri	10/31	Guest Speaker - Advanced analytics in genetics LAB - Guest Speaker - Modelling methane emissions from cattle	Lecture 24 LAB 9	
Mon	11/3	Intro to Machine learning in Animal Science	Lecture 25	Assignment 3 Due
Wed	11/5	Intro to Machine learning in Animal Science (2)	Lecture 26	
Fri	11/7	Intro to Machine learning in Animal Science (3) LAB - Machine learning exercise in python	Lecture 27 LAB 10	
Mon	11/10	Digital tools and on-farm sensors	Lecture 28	
Wed	11/12	Digital tools and on-farm sensors	Lecture 29	
Fri	11/14	Office hours LAB - Farm Visit	Lecture 30 LAB 11	
Mon	11/17	Precision nutrition - Guest Speaker	Lecture 31	
Wed	11/19	Precision nutrition - Guest Speaker	Lecture 32	
Fri	11/21	Office hours LAB - Precision nutrition - Guest Speaker	Lecture 33 LAB 12	
Mon	11/24	Digital Innovation	Lecture 34	Assignment 4 Due
Wed	11/26	Review & Course wrap-up	Lecture 35	
Fri	11/28	Office hours	Lecture 36	Final Paper Outline Due

Assessment Breakdown

Description	Weighting (%)	Due Date
Assignment #1	17.5%	Week 5
Assignment #2	17.5%	Week 8
Assignment #3	17.5%	Week 10
Assignment #4	17.5%	Week 13
Final Paper - Outline	5%	Week 13
Final Paper	25%	Week 15

Assessment Details

Assignment

Assignments 1-4 **17.5% each**

The assignments are worth 17.5% each. Each assignment will encompass independent exercises based on the lecture and lab content. Focus is on ability to apply concepts learned in lecture and lab to solve applied problem exercises provided.

Course Learning Outcomes Assessed: 1, 2, 3, 4, 5, 6, 7

Paper

Final Paper - New Technology Development - Proposal **25%**

Based on background knowledge obtained via the group presentation exercise, individuals will identify gaps and needs within the industry and propose a new technology (model, model application, sensor, digital tool). Format will be in the form of a research proposal.

Course Learning Outcomes Assessed: 4, 5, 6, 7

Research Proposal

Final Paper - Outline/Plan **5%**

Students will prepare a proposal for their final paper for feedback

Course Learning Outcomes Assessed: 4, 5, 6, 7

Last Day to Drop Course

The final day to drop Fall 2025 courses without academic penalty is the last day of classes: November 28

After this date, a mark will be recorded, whether course work is completed or not (a zero is assigned for missed tests/assignments). This mark will show on the student's transcript and will be calculated into their average.

Course Grading Policies

Submission of Assignments

Assignments should be submitted via the CourseLink Drop Box by the posted deadline.

Late Assignment

If you choose to submit assignments to the Dropbox tool late, the full allocated mark will be reduced by 10% per day after the deadline for the submission of the assignment to a limit of six days at which time access to the Dropbox folder will be closed. Late graded homework assignments will NOT be graded if they are submitted after the solutions have been posted to CourseLink/discussed in class. Extensions will be considered for medical reasons or other extenuating circumstances. If you require an extension, discuss this with the instructor as soon as possible and well before the due date. Barring exceptional circumstances, extensions will not be granted once the due date has passed. These rules are not designed to be arbitrary, nor are they inflexible. They are designed to keep you organized, to ensure that all students have the same amount of time to work on assignments, and to help to return marked materials to you in the shortest possible time.

Course Standard Statements

Course Policies

Course Policy on e-mail
Email is used as an important source of updates about this course. All official email from the instructor will be sent to your University email account (@uoguelph.ca) - university policy prohibits us from responding to non-UofG emails with any course information. It is expected that you are checking your official email account on a frequent basis. If you email a course instructor, please keep in mind that the instructors receive a lot of email each day. The instructors for this course are involved with other courses and research commitments, just as you are. In order to facilitate a response to your email, please consider the following guidelines: (1) Allow up to 24 to 48 hours for a response. Emails received outside of normal working hours will not be viewed until the next business day.

Course Policy on Technology

It is your responsibility to make sure you have access to a good internet connection and a suitable computer or electronic device. Your device needs to be capable of browsing and reviewing recorded or live video, audio and printed content from Courselink and across the internet. The University of Guelph's online Learning Management System (aka CourseLink) is integral to the delivery of this course. It is also your responsibility to ensure that you can access the course materials and complete online course requirements within the time allotted. If CourseLink is not accessible for a significant period of time (not including scheduled maintenance) deemed by the instructor to have had an impact on students' abilities to complete assignments, deadlines will be extended. In addition to accessing the Courselink website via a suitable web browser, additional software and applications may be used in the delivery of this course. These will include but not be limited to Zoom, Webex, MS Teams, MSOffice365 (Word, PowerPoint, Excel), Slido, email and a multi-purpose media player. The instructors will provide recommendations for software applications that are suitable for the purposes of the course but you will be ultimately responsible for finding, installing and maintaining any applications you use for this course. In any online sessions, you need to use technology to connect to course events as well as take notes and interact with the course material. This should be done in a way that respects your fellow students by not creating undue distractions (see below under Online Behaviour). Also, keep in mind that if your technology uses the University's network, the University's acceptable use policy also comes into play. http://www.uoguelph.ca/cio/sites/uoguelph.ca.cio/files/CIO-ITSecurity-03.1.3-AUP- Approved_0.pdf

Recording of Online Course Activities

Some learning activities in this course may be shifted from face-to-face instruction to remote online instruction. As a result of accessibility needs, learning activities may be recorded by the instructor or TAs and posted to CourseLink, Zoom, YouTube or another appropriate platform for grading and dissemination. As a result, individual students may be recorded during these sessions. By enrolling in this course, it is assumed that students agree to the possibility of being recorded during classes or other "live" course activities. If you prefer not to be distinguishable during a recording, you may: 1. Turn off your camera, 2. Mute your microphone (you should always mute your microphone when not participating anyway), 3. Edit your identification in the online session or application (e.g. use your initials instead), 4. Use the chat function to pose questions (again with identifying information adjusted) Students who express to the instructors or TAs that they, or a reference to their name or person, do not wish to be recorded may discuss possible alternatives or accommodations with the instructors or TAs.

Course Policy Regarding use of Electronic Devices and Recording of Lectures

In keeping with University policy, electronic recording of classes is expressly forbidden without consent of the individual instructor for that class. When recordings are permitted, they are solely for the use of the authorized student and may not be reproduced or transmitted to others, without the express written consent of the instructor. If the instructor provides a recording of the class or learning activity, these recordings are also solely for the use of the authorized student and may not be reproduced or transmitted to others, without the express written consent of the instructor. Please note that, if provided, these recordings are an optional additional tool for assisting with your learning and there is no guarantee a recording will be available for every online activity.

Online Behaviour – "Netiquette"

Inappropriate online behaviour will not be tolerated. Examples of inappropriate online behaviour include: · Posting inflammatory messages about your instructor or fellow students · Using obscene or offensive language online · Copying or presenting someone else's work as your own · Adapting information from the Internet without using proper citations or references · Buying or selling term papers or assignments · Posting or selling course materials to course notes websites · Having someone else complete your quiz or completing a quiz for/with another student · Stating false claims about lost quiz answers or other assignment submissions · Threatening or harassing a student or instructor online · Discriminating against fellow

students, instructors and/or TAs · Using the course website to promote profit-driven products or services · Attempting to compromise the security or functionality of the learning management system · Sharing your user name and password · Recording lectures without the permission of the instructor

Course Policy Regarding use of Artificial Intelligence (AI), Language Models, etc. (e.g. ChatGPT)

AI tools cannot be used for course assignments except as explicitly authorized by the instructor. If you are in doubt as to whether you are using an online learning support tool appropriately in this course, discuss this with the instructor. Any assignment content composed by any resource other than you, regardless of whether that resource is human or digital, must be attributed to the source through proper citation. Unattributed use of online learning support platforms and unauthorized sharing of instructional property on these platforms are forms of scholastic dishonesty and will be treated as such.

Standard Statements for Undergraduate Courses

Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy (https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-misconduct/) is outlined in the Undergraduate Calendar.

Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability. Use of the SAS Exam Centre requires students to make a booking at least 10 days in advance, and no later than the first business day in November, March or July as appropriate for the semester. Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time. For students at the Guelph campus, information can be found on the SAS website. (https://www.uoguelph.ca/sas/)

Accommodation of Religious Obligations

If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements.

See the Academic calendar for information on regulations and procedures for Academic Accommodations of Religious Obligations (https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-accommodation-religious-obligations/).

Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all undergraduate students except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in the Undergraduate Calendar - Dropping Courses (https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/dropping-courses/).

Email Communication

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

Health and Wellbeing

The University of Guelph provides a wide range of health and wellbeing services at the Vaccarino Centre for Student Wellness (https://wellness.uoguelph.ca/). If you are concerned about your mental health and not sure where to start, connect with a Student Wellness Navigator (https://wellness.uoguelph.ca/navigators/) who can help develop a plan to manage and support your mental health or check out our mental wellbeing resources (https://wellness.uoguelph.ca/shine-this-year/). The Student Wellness team are here to help and welcome the opportunity to connect with you.

Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g., final exam or major assignment).

Recording of Materials

Presentations that are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Resources

The Academic Calendars (http://www.uoguelph.ca/registrar/calendars/?index) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. See the Undergraduate Calendar for information on regulations and procedures for Academic Consideration. (https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-consideration-appeals-petitions/)