Term Information

Effective Term	Spring 2024

General Information

Course Bulletin Listing/Subject Area	Agricultural Systems Mgmt
Fiscal Unit/Academic Org	Food, Agric & Biological Eng - D1123
College/Academic Group	Food, Agric & Environ Science
Level/Career	Undergraduate
Course Number/Catalog	3586
Course Title	Digital Agriculture with Laboratory
Transcript Abbreviation	DigitalAgLab
Course Description	Digital Agriculture provides an introduction and overview of the digital processes, digital analytics and visualization, utilization of large data sets (crop, animal, weather, environment, and capital assets) coupled with artificial intelligence tools to produce actionable information that will help to enhance the profitability and sustainability of agricultural production systems.
Semester Credit Hours/Units	Fixed: 1

Offering Information

Length Of Course	14 Week, 12 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade
Repeatable	No
Course Components	Laboratory, Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus, Lima, Mansfield, Marion, Newark, Wooster

Prerequisites and Exclusions

Prerequisites/Corequisites	HCS 2260 or ANIMSCI 2260 or AEDECON 2005 or STAT 1450 or permission of instructor
Exclusions	AGSYSMT 2580 or AGSYSMT/HCS 3586
Electronically Enforced	Yes

Cross-Listings

Cross-Listings	HCS 3586

Subject/CIP Code

Subject/CIP Code	01.0301
Subsidy Level	Baccalaureate Course
Intended Rank	Sophomore, Junior, Senior

Requirement/Elective Designation

Sustainability

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- Successful students will analyze sustainability at a more advanced and in-depth level than in the Foundations component.
- Successful students will integrate approaches to sustainability by making connections to out-of- classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in f
- Successful students will analyze and explain how social and natural systems function, interact, and evolve over time; how human well-being depends on these interactions; how actions have impacts on subsequent generations and societies globally; and h
- Students will analyze sustainability at a more advanced and in-depth level.
- Successful students will integrate approaches to sustainability by making connections to out-of- classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in t

Content Topic List

- Introduction to Digital Agriculture and its Role in Sustainability
- Global Navigation Satellite Systems (GNSS) in Agriculture and Natural Resource Conservation
- ArcGIS and Applications in Agricultural Sustainability
- Farm Management Information Systems (FMIS) for Sustainable Management
- Variable Rate Technology and its Role in Long-Term Soil Health and Sustainability
- Soil Health Soil Sampling and Soil Sensing
- Yield Monitoring Technologies for Optimal Resource Management
- Historical Yield Data and its Implications for Sustainability
- Artificial Intelligence Primer
- Artificial Intelligence and Crop Care
- Controller Area Networks (CAN) and Connected Machines
- The Ethics of Data Ownership, Aggregation, and Cloud Computing
- Google Earth Applications in Production and Urban Agriculture
- Remote Sensing and Applications in Sustainable Agriculture
- Drone Applications in Sustainable Agriculture
- Precision Conservation Management
- Controlled Environment Agriculture
- Tracking Weather and Climate Change
- Precision Livestock Farming Systems
- Managing Pasture Based Livestock Systems
- Crop and Animal Modeling
- Precision Irrigation and Controlled Drainage for Enhance Water Quality
- Internet of Things (IoT) and Sustainability
- On-Farm Research and its role in Digital Agriculture.
- Data Analytics and Visualization for Digital Agriculture
- AI in Marketing and Agricultural Supply Chain Logistics
- Application of Blockchain Technology in Agricultural Supply Chain
- Enterprise Agriculture and Sustainability
- Laboratories

  Data-Driven Resource Allocation

  ArcGIS Applications in Sustainable Agricultural Production
- Laboratories

  Variable Rate Technology and Soil Health

  Yield Monitoring for Improved Resources Utilization

  Data Infrastructure to Support Economic and Ecological Outcomes

  Connected Machines and CAN Data
- Laboratories

  Google Earth Applications in Production and Urban Agriculture

  Remote Sensing for Sustainability

  Drones for Environmental Monitoring and Sustainability

Mapping, Modeling, and Data Analytics using ArcGIS

- Laboratories

Introduction to R and On-Farm Research

Role of Big Data in Sustainability

Supply Chain Management and Sustainability

Blockchain Applications for Traceability in the Food Supply Chain

Sought Concurrence Yes

Attachments

- HCS3585 GE justification Final_20211130.pdf: GE Justification

  (GEC Model Curriculum Compliance Stmt. Owner: Trefz,Kelvin Eugene)

- AGSYSMT_HCS_3585_3586_Concurrency_request.pdf: List of Depts Concurrence

  (List of Depts Concurrence Requested From. Owner: Trefz,Kelvin Eugene)

- Course_Review_Concurrence_Form_3586_20211210.pdf: Concurrency Request

  (Concurrence. Owner: Trefz,Kelvin Eugene)

- Course_Review_Concurrence_Animal_Sciences_AGSYSMT_HCS_3585_20211210.pdf: Animal Sciences 3585

  (Concurrence. Owner: Trefz,Kelvin Eugene)

- Course_Review_Concurrence_Animal_Sciences_AGSYSMT_HCS_3586_20211210.pdf: Animal Sciences 3586

  (Concurrence. Owner: Trefz,Kelvin Eugene)

- Course_Review_Concurrence_Civil_Environmental_Geodetic_Engineering_AGSYSMT_HCS 3585_and_3586.pdf: CECE 3585 and 3586

  (Concurrence. Owner: Trefz,Kelvin Eugene)

- Course_Review_Concurrence_Geography_AGSYSMT_HCS_3585_and_3586.pdf: Geography 3585 and 3586

  (Concurrence. Owner: Trefz,Kelvin Eugene)

- Course_Review_Concurrence_Knowlton Schl of Architecture_AGSYSMT_HCS_3585_and_3586.pdf: Knowlton 3585 and 3586

  (Concurrence. Owner: Trefz,Kelvin Eugene)

- Course_Review_Concurrence_SENR_AGSYSMT_HCS_3585_20211210.pdf: SENR 3585

  (Concurrence. Owner: Trefz,Kelvin Eugene)

- Course_Review_Concurrence_SENR_AGSYSMT_HCS_3586_20211210.pdf: SENR 3586

  (Concurrence. Owner: Trefz,Kelvin Eugene)

- AGSYSMT_HCS_3585_3586_Cover_Letter_Revised.docx: Old Cover Letter to Committee

  (Cover Letter. Owner: Trefz,Kelvin Eugene)

- AGSYSMT_HCS_3586_Cover_Letter.docx: New Cover Letter to Committee

  (Cover Letter. Owner: Trefz,Kelvin Eugene)

- AGSYSMT_HCS_3586_Syllabus.docx: New Syllabus

  (Syllabus. Owner: Trefz,Kelvin Eugene)

- AGSYSMT_HCS_3586_Course_Construction.docx: Course Construction

  (Other Supporting Documentation. Owner: Trefz,Kelvin Eugene)

- AGSYSMT_HCS_3586_Readings.docx: Readings

  (Other Supporting Documentation. Owner: Trefz,Kelvin Eugene)

- AGSYSMT_HCS_3586_Teaching_Schedule_and_Interdisciplinary_Learning_Outcomes_Table.docx: Teaching Schedule

  (Other Supporting Documentation. Owner: Trefz,Kelvin Eugene)

- AGSYSMT_HCS_3586_Interdisciplinary_Team_Taught_Inventory.docx: Interdisciplinary

  (Other Supporting Documentation. Owner: Trefz,Kelvin Eugene)

- AGSYSMT_HCS_3586_Example_High-Impact_Practice_Interdisciplinary_Team-Teaching.docx: High Impact

  (Other Supporting Documentation. Owner: Trefz,Kelvin Eugene)

- AGSYSMT_HCS_3586_Course_Alignment_Map_Revised.docx: Course Alighment Map

(Other Supporting Documentation. Owner: Trefz,Kelvin Eugene)

Comments

- Please see Panel feedback email sent 10/13/2022. *(by Hilty,Michael on 10/13/2022 11:30 AM)*
- Revise as per COAA via email message 7 February 2022

  Revise as discussed on 27 January 2022

  Revise as per discussion 19 January 2022

  Revise as per discussion 6 January 2022 *(by Osborne,Jeanne Marie on 02/07/2022 04:29 PM)*
- Concurrences requested 01/12/22, as of 12/27/21:

  Animal Sciences – Concurs

  AEDE (management, cryptocurrencies) – not received

  SENR – Concurs

  Geography – Concurs

  College of Engineering including

  Computer Science and Engineering (cloud computing). – not received

  Civil, Environmental & Geodetic Engineering– Concurs

  Knowlton School of Architecture – Concurs *(by Trefz,Kelvin Eugene on 01/12/2022 03:25 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Trefz,Kelvin Eugene	12/10/2021 10:44 AM	Submitted for Approval
Approved	Chen,Qian	12/28/2021 09:54 AM	Unit Approval
Revision Requested	Osborne,Jeanne Marie	01/06/2022 02:17 PM	College Approval
Submitted	Trefz,Kelvin Eugene	01/12/2022 03:27 PM	Submitted for Approval
Approved	Chen,Qian	01/13/2022 01:09 AM	Unit Approval
Revision Requested	Osborne,Jeanne Marie	01/19/2022 02:11 PM	College Approval
Submitted	Trefz,Kelvin Eugene	01/24/2022 04:36 PM	Submitted for Approval
Approved	Chen,Qian	01/25/2022 03:42 AM	Unit Approval
Revision Requested	Osborne,Jeanne Marie	01/28/2022 10:28 AM	College Approval
Submitted	Trefz,Kelvin Eugene	01/28/2022 10:46 AM	Submitted for Approval
Approved	Chen,Qian	01/28/2022 12:06 PM	Unit Approval
Revision Requested	Osborne,Jeanne Marie	02/07/2022 04:29 PM	College Approval
Submitted	Trefz,Kelvin Eugene	02/10/2022 09:43 AM	Submitted for Approval
Approved	Chen,Qian	02/10/2022 10:43 AM	Unit Approval
Approved	Osborne,Jeanne Marie	02/11/2022 01:40 PM	College Approval
Revision Requested	Hilty,Michael	05/17/2022 04:35 PM	ASCCAO Approval
Submitted	Trefz,Kelvin Eugene	09/09/2022 09:57 AM	Submitted for Approval
Approved	Chen,Qian	09/09/2022 10:50 PM	Unit Approval
Approved	Osborne,Jeanne Marie	09/12/2022 10:55 AM	College Approval
Revision Requested	Hilty,Michael	10/13/2022 11:30 AM	ASCCAO Approval
Submitted	Trefz,Kelvin Eugene	08/01/2023 04:12 PM	Submitted for Approval
Approved	Chen,Qian	08/02/2023 11:40 AM	Unit Approval
Approved	Osborne,Jeanne Marie	08/04/2023 12:43 PM	College Approval
Pending Approval	Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Hilty,Michael Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	08/04/2023 12:43 PM	ASCCAO Approval

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August 1, 2023

Dr. Jim Fredal, Faculty Chair of the ASCC Themes Panel
Dr. Maria Conroy, Faculty Chair of the Theme Advisory Group: Sustainability
Michael Hilty, Curriculum and Assessment Assistant
ASC Curriculum and Assessment Services
College of Arts and Sciences
The Ohio State University

Dear Jim, Maria, and Michael,

Please accept this letter as our response to Michael's email of October 13, 2022, regarding approval of AGSYSMT & HCS 3585 and 3586. The following email is repeated below for your reference.

From: *Hilty, Michael <hilty.70@osu.edu>*
Sent: *Thursday, October 13, 2022, 11:26 AM*
To: *Trefz, Kelvin <trefz.1@osu.edu>; Osborne, Jeanne <osborne.2@osu.edu>; Luikart, Meredith <luikart.6@osu.edu>*
Cc: *Putikka, Bill <putikka.1@osu.edu>; Conroy, Maria <conroy.36@osu.edu>; Vankeerbergen, Bernadette <vankeerbergen.1@osu.edu>; Steele, Rachel <steele.682@osu.edu>; Cody, Emily <cody.50@osu.edu>*
Subject: *Agricultural Systems Management & HCS 3585 and 3586*

Good morning,

On Tuesday, September 27th, the Themes 2 Panel of the ASC Curriculum Committee reviewed a new GEN Theme: Sustainability with High-Impact Practice: Interdisciplinary Team-Teaching request for Agricultural Systems Management & HCS 3585 and 3586. Please see below for the Panel's feedback.
GEN Theme: Sustainability:

The Panel unanimously approved the request with one contingency and one recommendation. As a reminder, the Panel's contingency must be satisfied in a revision submitted to www.curriculum.osu.edu while the Panel's recommendation may be implemented when the course is next taught.

- ***Contingency:*** *The reviewing faculty ask that more clarification be provided regarding which textbook is being referenced and utilized within the course syllabus and how this chosen text will connect to the GEN Theme: Sustainability Goals and ELOs.*

- ***Recommendation:*** *The reviewing faculty recommend clearly establishing student expectations regarding what texts they will need to purchase and utilize on the course syllabus.*

High-Impact Practice: Interdisciplinary Team-Teaching

The Panel did not vote on the request as they would like the following feedback items addressed:

- *The reviewing faculty thank the department for a thoughtful revision, but are still unable to see how the instructors co-teaching the course will engage in Interdisciplinary Team-Teaching as defined by the High-Impact Practice forms created by the Office of Academic Affairs (see here: https://oaa.osu.edu/sites/default/files/uploads/generaleducation-review/new-ge/interdisciplinary-team-courses-description-expectations.pdf). They ask that the course proposer read through this document from the Office of Academic Affairs to see how a High-Impact Practice Interdisciplinary Team-Taught course is different from simply a co-taught course.*

- *While the reviewing faculty acknowledge that the course is being co-taught, in order to count within the Interdisciplinary Team-Teaching category, a course must establish that an interdisciplinary coteaching style will be developed and introduced, as defined by the Office of Academic Affairs. For example:*

    - *"In multidisciplinary courses, faculty present their individual perspectives one after another, leaving differences in underlying assumptions unexamined and integration up to the students. In interdisciplinary courses, whether taught by teams or individuals, faculty interact in designing a course, bringing to light and examining underlying assumptions and modifying their perspectives in the process. They also make a concerted effort to work with students in crafting an integrated synthesis of the separate parts that provides a larger, more holistic understanding of the question, problem or issue at hand. Smith's iron law bears repeating: 'Students shall not be expected to integrate anything the faculty can't or won't' (quoted in Gaff, 1980, pp. 54-55). (Klein & Newall, 12)."*

    - *"A team-taught course requires that two or more faculty from different disciplines, programs or departments develop and offer a course together. Team-taught courses must be taught collaboratively by faculty who integrate distinctly separate disciplines, model interdisciplinary academic exchange, and demonstrate the interdisciplinary nature of the course. This includes explicitly synthesizing across and between the disciplines that each instructor brings to the team-taught, interdisciplinary course."*

    - *"Teaching partners are expected to collaborate on defining the objectives for the course, putting together the course materials, conducting the formal instruction of students, and evaluating student performance. Note that courses in which one faculty member of record convenes the course and invites one or more guest speakers to take part in the class are not considered team-taught courses."*

- *Additionally, the reviewing faculty ask that the departments reach out to Bernadette Vankeerbergen (Vankeerbergen.1), ASC Assistant Dean for Curriculum, and Meg Daly (Daly.66), Associate Dean for Undergraduate Education, to discuss alternative ways for this course to be proposed as the they are still unclear on the 3+1 model and how/where the team-teaching will be taking place.*

- *The reviewing faculty request a cover letter that details all changes made in response to their feedback.*

I will return Agricultural Systems Management & HCS 3585 and 3586 to the departmental queues via curriculum.osu.edu in order to address the Panel's feedback above.

Should you have any questions, please do not hesitate to reach out to Bill Putikka, faculty Chair of the ASCC Themes 2 Panel, Maria Conroy, faculty Chair of the Theme Advisory Group: Sustainability, or me.

All my best,
Michael

THE OHIO STATE UNIVERSITY

Michael Hilty
Curriculum and Assessment Assistant
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Pronouns: he/him/his, they/them/theirs / Honorific: Mx.

We would like to thank the committee for your input on Digital Agriculture (AGSYSMT/HCS 3585) and Digital Agriculture with Laboratory (AGSYSMT/HCS 3586). This letter responds to the one (1) contingency and one (1) recommendation and provides more information as requested on Interdisciplinary Team Teaching in your email of October 13, 2022.

> *Note: After discussion with Bernadette Vankeerbergen (Vankeerbergen.1), ASC Assistant Dean for Curriculum, and Meg Daly (Daly.66), Associate Dean for Undergraduate Education the Team has decided to keep AGSYSMT/HCS 3585 as a 3 credit hours course without the laboratory component and combine the lecture and laboratory components in to one course. - AGSYSMT/HCS 3586 as 4 credit hours offering.*

GEN Theme: Sustainability:

The Panel unanimously approved the request with one contingency and one recommendation. As a reminder, the Panel's contingency must be satisfied in a revision submitted to curriculum.osu.edu while the Panel's recommendation may be implemented when the course is next taught.

1. Contingency: The reviewing faculty ask that more clarification be provided regarding which textbook is being referenced and utilized within the course syllabus and how this chosen text will connect to the GEN Theme: Sustainability Goals and ELOs.

- *1.a The syllabus (AGSYSMT/HCS 3585-page 7-8) now clearly indicates the three main textbooks, plus four other optional textbooks being used. Additionally, the readings for the main textbooks are clearly indicated in the Course Schedule, at the end of the syllabus, and in Carmen.*

- *1.b The Sustainably Goals and ELOs are paired with the Course CLOs which are linked to the textbook readings as shown on AGSYSMT/HCS 3586-pages 2-4. In addition, the AGSYSMT_HCS_3586_Course_Alignment_Map_Revised has the Theme Goals and ELO's specifically linked to the textbook readings.*

2. Recommendation: The reviewing faculty recommend clearly establishing student expectations regarding what texts they will need to purchase and utilize on the course syllabus.

- *2.a AGSYSMT/HCS 3586 - page 7) of the syllabus clearly states that each of the textbooks listed are available as free - eBooks online with the Ohio State University Libraries. In most cases, the students can download the required materials and they can also elect to read them online without downloading.*

- *2.b All readings (textbooks and articles) are listed in the Course Schedule under "Readings" at the end of the syllabus. In addition, we have put together a document (AGSYSMT_HCS_3586_Readings) that list the lectures along with textbook information and the corresponding chapter readings.*

High-Impact Practice: Interdisciplinary Team-Teaching

The Panel did not vote on the request as they would like the following feedback items addressed:

- *3. The reviewing faculty thank the department for a thoughtful revision, but are still unable to see how the instructors co-teaching the course will engage in Interdisciplinary Team-Teaching as defined by the High-Impact Practice forms created by the Office of Academic Affairs (see here: https://oaa.osu.edu/sites/default/files/uploads/generaleducation-review/new-ge/interdisciplinary-team-courses-description-expectations.pdf). They ask that the course proposer read through this document from the Office of Academic Affairs to see how a High-Impact Practice Interdisciplinary Team-Taught course is different from simply a co-taught course.*

  3.a. From the Descriptions, Expected Learning Outcomes, and Rubrics for Interdisciplinary Team-Taught Courses: Interdisciplinary Team-Taught courses (adapted from Association for Interdisciplinary Studies and ASC Team-teaching guidelines)

  - 3.a.1. Integrative, Interdisciplinary, Team-Taught courses must include each of ***these three elements***. A clear articulation of the interdisciplinary nature of the course should be included in the course proposal. As Interdisciplinary courses, they will meet these criteria.

  3.b "Address a topic that is too broad or complex to be dealt with adequately by a single discipline or profession."

  - *3.b.1. Digital Agriculture is also known as smart farming. It encompasses crop management practices, digital technology, and data analytics, and their impact on social, economic, and sustainability issues. FABE has expertise in digital technology and data analytics. HCS has expertise in crop management practices and in data analytics. The faculty in both Departments are aware about social, economic, and sustainability issues in agriculture as they are involved in research, teaching, and extension. They interact with the stakeholders on a regular basis and are aware of current issues.*

  3.c. "Draw on different disciplinary perspectives."

- *3.c.1. Two Departments are involved in this course offering and both offer several majors and specializations with multidisciplinary perspectives. FABE is offering Agricultural Systems Management, Construction Systems Management, and Food, Agricultural and Biological Engineering. HCS is offering Sustainable Agriculture, Sustainable Plant Systems [Agroecology, Agronomy, Horticulture, Plant Biosciences, and Turfgrass Science], and Professional Golf Management. So, faculty from both Departments will bring multidisciplinary perspectives for teaching and use the same approach for addressing sustainability issues.*

3.d. "Integrate their insights through construction of a more comprehensive perspective."

- ***3.d.1. Sustainability is an integral part of each Department's teaching mission. It became the organizing agent for these courses and refocused the faculty's actions during the course design, selection of educational tools, assessments, and development of the syllabus.***

4. Interdisciplinary Team-Teaching category

- *4.a. While the reviewing faculty acknowledge that the course is being co-taught, in order to count within the Interdisciplinary Team-Teaching category, a course must establish that an interdisciplinary coteaching style will be developed and introduced, as defined by the Office of Academic Affairs. For example:*

- *4.b. "In multidisciplinary courses, faculty present their individual perspectives one after another, leaving differences in underlying assumptions unexamined and integration up to the students. In interdisciplinary courses, **whether taught by teams or individuals**, faculty interact in designing a course, bringing to light and examining underlying assumptions and modifying their perspectives in the process. They also make a concerted effort to work with students in crafting an integrated synthesis of the separate parts that provides a larger, more holistic understanding of the question, problem or issue at hand. Smith's iron law bears repeating: 'Students shall not be expected to integrate anything the faculty can't or won't' (quoted in Gaff, 1980, pp. 54-55). (Klein & Newall, 12)."*

  - ***4.b.1. Interdisciplinary courses can be taught by teams or individuals.***

  - ***4.b.2. Faculty from both Departments with expertise in multiple disciplines designed this course focusing on the underlying assumptions, modifying perspectives, and developing a blended or holistic views.***

  - ***4.b.3. The faculty not only present a holistic understanding of the course concepts but also relate it back to previous knowledge and identify where these concepts can be used within the course (AGSYSMT/HCS 3586).***

- *4.c. "A team-taught course requires that two or more faculty from different disciplines, programs or departments develop and offer a course together. Team-taught courses must be taught collaboratively by faculty who integrate distinctly separate disciplines, model interdisciplinary academic exchange, and demonstrate the interdisciplinary nature of the course. This includes explicitly synthesizing across and between the disciplines that each instructor brings to the team-taught, interdisciplinary course."*

- *We provide background about AGSYSMT/HCS 3586 course development. It was developed because of several meetings in 2021 between FABE and HCS faculty and staff involved in teaching Digital Agriculture focused courses. This group developed a list of learning objectives for AGSYSMT/HCS 3586 (4 credit hours). We feel this meets the criteria of a cross-departmental collaborative process and with interdisciplinary learning objectives at its core.*

- *We have included a teaching schedule and related interdisciplinary learning outcomes in a separate attachment. The plan is to co-teach AGSYSMT/HCS 3586. For the 28 lectures in the term, 13 lectures will be co-led by the instructors that will allow for integration of content presented in previous and current sessions. Fifteen lectures will be led by individual instructors (seven from FABE and eight from HCS) to discuss their disciplinary expertise. This has also been added to "Mode of Delivery" section of the syllabus. Instructors will share grading duties and evaluation will be based on collaboratively defined criteria. This information has been added to the "Grading" section of the syllabus. The instructors will meet weekly outside of the classroom to discuss the lecture topics and review plans for integrating them.*

- *4.c.1. We have two or more faculty from different Departments with expertise in multiple disciplines within each department offering these courses (AGSYSMT/HCS 3586).*

- *4.c.2. The faculty have collaborated in developing each topic of this course and have synthesized content across and between the disciplines. This information has been used in developing the course content and will be using multi-disciplinary teaching approaches, along with suitable assessments.*

- *4.c.3. The faculty have integrated ideas/concepts from different disciplines, have shown how the basic concept of each discipline generates the next step in the process of building on the previous facts and concepts, and have synthesized the information into the new/redesigned course offerings - AGSYSMT/HCS 3586 (4 credits).*

- *4.c.4. The students will receive formal instruction from each of the faculty involved in the course.*

- *4.c.5. Each of the faculty involved in the course offering have contributed to the assessments used in this course. The question bank for all the quizzes will be generated by all the faculty involved in teaching. Evaluations will be graded by the faculty.*

- *4.d "Teaching partners are expected to collaborate on defining the objectives for the course, putting together the course materials, conducting the formal instruction of students, and evaluating student performance. Note that courses in which one faculty member of record convenes the course and invites one or more guest speakers to take part in the class are not considered team-taught courses."*

  - *4.d..1 All of this is presented in the AGSYSMT_HCS_3586_Course_Construction document.*

  - *4.d.2. Faculty from both departments are involved in each phase of course development and execution.*

  - *4.d.3. An example of a lecture topic is in AGSYSMT_HCS_3586_Example_High-Impact_Practice_Interdisciplinary_Team-Teaching.*

- *4.d.4. AGSYSMT_HCS_3586_Course_Construction document has detailed information on how the course was constructed.*

- 4.e *Additionally, the reviewing faculty ask that the departments reach out to Bernadette Vankeerbergen (Vankeerbergen.1), ASC Assistant Dean for Curriculum, and Meg Daly (Daly.66), Associate Dean for Undergraduate Education, to discuss alternative ways for this course to be proposed as the they are still unclear on the 3+1 model and how/where the team-teaching will be taking place.*

  - *4.e.1. The Departments met with Meg Daly and Bernadette Vankeerbergen and discussed interdisciplinary team teaching.*

  - *4.e.2. Meg Daly confirmed that the committee prefers faculty from both the departments to be present for the lectures.*

  - *4.e.3. Meg and Bernadette suggested that we create AGSYSMT/HCS 3585 as a 3 credit hours course without the laboratory component and AGSYSMT/HCS 3586 as a 4 credit hours course with the laboratory component incorporated in the course.*

  - *4.e.4. The 3 + 1 may be developed at a future date once we understand how the 3 +1 works between separate lecture and laboratory courses.*

  - *4.e.5. Note: After discussing with Bernadette Vankeerbergen (Vankeerbergen.1), Assistant Dean for Curriculum and Meg Daly (Daly.66), Associate Dean for undergraduate education, we have decided to keep AGSYSMT/HCS 3585 as a 3 credit hours course without the laboratory component and combine the lecture and laboratory components in to one course - AGSYSMT/HCS 3586 as a 4-credit hour offering.*

- *The reviewing faculty request a cover letter that details all changes made in response to their feedback.*

  - Please refer to this letter.

Sincerely.

Scott A. Shearer, Ph.D., P.E.
Professor and Chair, FABE

David J. Barker, Ph.D.
Professor & Associate Chair for Academic Programs HCS

Digital Agriculture Syllabus

AGSYSMT/HCS 3586 Spring 2024

Course Information

Course times and location: Tuesdays and Thursdays; time and location: TBD
Credit hours: 3
Mode of delivery: In Person

Instructors

Name: Dr. Scott A. Shearer
Email: shearer.95@osu.edu (preferred)
Phone: 614-292-7284
Office location: 590 Woody Hayes Drive
Office hours: TBD.

Department of Horticulture and Crop Science:

Name: Dr. David Barker
Office location: 226 Kottman Hall
E-mail: barker.169@osu.edu (preferred)
Phone: (614) 247-6258
Office Hours: TBD

Name: Dr. Guilherme Signorini
Office location: 225 Howlett Hall
E-mail: signorini.2@osu.edu (preferred)
Phone: no phone
Office Hours: TBD

Name: Dr. Alex Lindsey
Office location: 312A Kottman Hall
E-mail: lindsey.227@osu.edu (preferred)
Phone: (614) 292-3864
Office Hours: TBD

Course Coordinator

Department of Horticulture and Crop Science:
Name: Dr. Ramarao Venkatesh
301 Kottman Hall
E-mail: venkatesh.1@osu.edu (preferred)
Phone: (614) 688-4204
Office Hours: TBD

Preferred contact method:

First contact with any instructor should be at Ohio State email address. Students will receive a response within **24 hours**.
Class-wide communications will be sent through the Announcements tool in CarmenCanvas. Please check your notification preferences (go.osu.edu/canvas-notifications) to be sure you receive these messages.

Course Prerequisites

HCS 2260 or ANIMSCI 2260 or AEDECON 2005 or STAT 1450.

Course Exclusions

AGSYSMT 2580 or AGSYSMT/HCS 3586

Course Description

Catalog Description: Digital Agriculture provides an introduction and overview of the digital processes, digital analytics and visualization, utilization of large data sets (crop, animal, weather, environment, and capital assets) coupled with artificial intelligence tools to produce actionable information that will help to enhance the profitability and sustainability of agricultural production systems.

Extended Description: Digital Agriculture provides an overview of the emergence of data-driven processes and using it to make management decisions in agriculture. This advancement of digital tools and analytics seeks to combine large data sets and sources with crop, animal, weather, environment, and capital asset management models, coupled with artificial intelligence, to produce actionable information to enhance the sustainability and profitability of agriculture production systems. Simply stated, "digital agriculture" is the "generation and analysis of large data sets to produce actionable information." This course seeks to provide perspective and a lexicon for students interested in learning more about the data-driven agriculture. Recent developments including cloud computing and the "Internet of Things" are reshaping nearly every facet of agricultural production including food, fiber, energy, and processing and distribution of products downstream of the farm gate. It is the first in a series of courses that will address the impact of data-driven management decisions on agricultural production, sustainability, and food and energy security.

For digital agriculture, sustainability is defined as the ability of growers to have agricultural production systems that are efficient and profitable, that minimizes the impact to the land, air, and water, and that enhances the quality of life for local, national, and global communities. The following are some of the *sustainability concepts* covered in this course: Carbon Cycling and Sequestration, Water Quality and Quantity, Food Production Optimization and Efficiency, Nitrogen and Phosphorus Cycling and Use Efficiency, Climate Smart Agriculture, Food Safety, and Food Security.

General Education Goals and Expected Learning Outcomes

As part of the Sustainability Theme of the General Education curriculum, this course is designed with the following Goals and Expected Learning Outcomes:

GE Goal 1: Successful students will analyze sustainability at a more advanced and in-depth level than in the Foundations component.

Expected Learning Outcomes (ELO)

- ELO 1.1 (IITT ELO 1.1) Engage in critical and logical thinking about the topic or idea of sustainability. CLO 1.1, CLO 1.2, CLO 1.4
    - IITT ELO 1.1.a Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. CLO 1.1, CLO 1.2
    - IITT ELO 1.1.b Analysis: Interpret and evaluate information from multiple sources and multiple disciplinary perspectives to develop a comprehensive analysis or synthesis, and thoroughly question the viewpoints of experts and professionals. CLO 1.2, CLO 1.4
    - IITT ELO 1.1.c Critical thinking & analysis Systematically and methodically analyze their own and others' assumptions using more than one disciplinary lens and carefully evaluate the relevance of contexts when representing a position. CLO 1.2, CLO 1.4
- ELO 1.2 (IITT ELO 1.2) Engage in an advanced, in-depth, scholarly exploration of the topic or idea of sustainability. CLO 1.2, CLO 1.4, CLO 2.5
    - IITT ELO 1.2.a Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. CLO 1.2, CLO 1.4, CLO 2.5

GE Goal 2: Successful students will integrate approaches to sustainability by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in future.

Expected Learning Outcomes

- ELO 2.1 (IITT ELO 2.1) Identify, describe and synthesize approaches or experiences as they apply to sustainability. CLO 1.2, CLO 2.1, CLO 2.2, CLO 2.5
    - IITT ELO 2.1.a Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. CLO 2.1, CLO 2.5
    - IITT ELO 2.1.b Multiple perspectives: Evaluate and apply diverse perspectives to complex subjects from multiple cultural and disciplinary lenses as appropriate. CLO 1.2, CLO 2.2, CLO 2.4
- ELO 2.2 (ITC ELO 2.2) Demonstrate a developing sense of self as a learner through reflection, self-assessment and creative work, building on prior experiences to respond to new and challenging contexts. CLO 2.3, CLO 2.4
    - IITT ELO 2.2.a Self-awareness: Evaluates the impacts of cross disciplinary synthesis of the issue on themselves, the scholarly inquiry, the local and global systems and also considers the long-term impact of the work. CLO 2.3

- IITT ELO 2.2.b. Empathy: Interpret and explain the issue under consideration from the perspectives other than their own and more than one worldview and demonstrates openness towards others in the academic community and their perspectives. CLO 2.4

GE Goal 3: Successful students will analyze and explain how social and natural systems function, interact, and evolve over time; how human well-being depends on these interactions; how actions have impacts on subsequent generations and societies globally; and how human values, behaviors and institutions impact multifaceted potential solutions across time.

Expected Learning Outcomes

- ELO 3.1 Describe elements of the fundamental dependence of humans on Earth and environmental systems, and on the resilience of these systems. CLO 1.3
- ELO 3.2 Describe, analyze, and critique the roles and impacts of human activity and technology on both human society and the natural world, in the past, present and future. CLO 1.3

  ELO 3.3 Devise informed and meaningful responses to problems and arguments in the area of sustainability based on the interpretation of appropriate evidence and an explicit statement of values. CLO 1.1

AGSYSMT/HCS 3586 course fulfills ALL of the Sustainability Theme Learning Goals and Expected Learning Outcome:

Students will engage in analyzing sustainability at a more advanced and in-depth level. Students will use integrated approaches to study sustainability by making connections between their out-of-classroom experiences, academic knowledge across disciplines, and past/future work. Students will analyze and explain:

a) how social and natural systems function, interact, and evolve over time.
b) how human well-being depends on these interactions.
c) how these actions have an impact on subsequent generations and societies globally; and
d) how human values, behaviors, and institutions have an impact on multifaceted potential sustainability solutions across time.

This course fulfills the General Education learning objectives for the Sustainability Theme by:

- Engaging in critical and logical thinking about the topic of sustainability through a series of lectures, discussions, and writing (Homework, Guest Speaker Reflections, Technical Feasibility and Sustainability Study). The course will expose students to different types of data sets that are generated on a farm and how they could be used to implement the best crop management practices that helps to reach sustainability goals.
- Engaging in a semester-long in-depth and advanced scholarly exploration of sustainability in the Technical Feasibility and Sustainability Study and in the homework's.
- Analyzing, and providing visualization of the data sets that helps to communicate the results to public, stakeholder groups (local or global communities) that helps to make informed decisions towards a more sustainable future.

- Throughout the semester students will submit written reflections on the Guest Speakers, descriptions of their work, and their view of the impact of digital agriculture on sustainability for the next "ten years.". Additional writings about, thought leaders, current trends, sources of data generated on the farm, and the future of digital agriculture will help to develop the student's knowledge base in digital agriculture and sustainability. This will improve their ability to interact with other students from other disciplines and stakeholders who are interested in sustainability.
- The lecture topics provide descriptions of the interactions between human activity, technology, and societal norms in relation to the environment and impact of their interactions on sustainability based on the data generated from various sources on the farm. The delicate balance of meeting societal needs with the increasing population requires a new approach. Students will learn how data is gathered on the farm and analyzed to make informed decisions taking into consideration productivity and sustainability.
- Describing, analyzing, and critiquing the roles and impacts of human activity and technology on both the society and the environment will help students to understand there needs to be a delicate balance between the needs and desires of an increasing population considering the natural resources required to meet those demands in the future.
- Devising informed and meaningful responses to problems and issues related to sustainability based on the interpretation of appropriate evidence and an explicit statement of values. Knowledge gained in this course will help students to understand digital technologies and their application to evaluate the impact of different conventional and new food production systems on sustainability. The experiences from the course will allow the student to make informed decisions in real life about the impact of production practices on sustainability.

This course meets the expectations of the integrative, interdisciplinary, team-taught practice. The subject matter encompasses, biological, engineering, economic and social scales that are too broad or complex to be dealt with adequately by a single discipline or profession.

This course is taught collaboratively by two departments - Food, Agricultural and Biological Engineering, (FABE), and Horticulture and Crop Science, (HCS). Although this course addresses several sustainability concepts (Carbon Cycling and Sequestration, Climate-Smart Agriculture, Food Safety, Food Security, Food Production Optimization and Efficiency, Nitrogen and Phosphorus Cycling and Use Efficiency, Water Quality and Quantity), as a generalization, FABE faculty will take an engineering/technology approach to address sustainability topics and HCS will take a biophysical approach focused on plant science. Within HCS, a range of interdisciplinary approaches including whole plant ecophysiology and agricultural supply chain management (applied economics) will be considered to address sustainability topics. Lectures will be conducted separately by the faculty allowing the respective disciplinary approaches to be presented to students. The homework assignments (7), Guest Speaker Reflection (3) and Technical Feasibility and Sustainability Study (1) will allow students to draw upon these various disciplinary approaches to the topic. For example, Carbon Cycling and Sequestration might include an engineering component (no-tillage vs full tillage cultivation), a biophysical component (crop selection, or fertilization to promote plant root growth and productivity), or a value chain approach (marketing of organic vs conventional produce).

Students will work with large scale complex problems throughout the entire course centered on food system operations (small holder vs corporate) that have an impact on the environment, sustainability, profitability, how technology impacts food, fuel, fiber, energy production practices, logistics, and careers (current and future). Students will have opportunities to revisit, analyze, and synthesize the material taught in the course. Students can compare their knowledge and understand the complex issues of digital agriculture, food, fuel, and fiber production systems and chart how their knowledge and understanding has changed over time. The content and procedures learned in

this course will not only provide the basis for completing class assignments and activities but can be applied to future courses and employment.

Course Goals and Course Learning Outcomes (CLO)

By the end of this course, students should successfully be able to:

Course Goal 1. Students will analyze sustainability at a more advanced and in-depth level.

CLO 1.1 *Develop* responses to problems and arguments in the area of sustainability based on data, definitions, principles, ~~and~~ theories, methods, history, and development of data driven agriculture that allow effective communication of results to farmers/workforce and society that helps to plan their farm operations. ELO 1.1, 3.3 – IITT 1.1.a

CLO 1.2 Using digital agriculture *analyze* how multiple sources and disciplines, expert viewpoints, and technologies have an impact on sustainability. Show the impact on the environment, political, natural, cultural, social aspects and allow farmers to have economic and environmental benefits from their operations. ELO 1.1, 1.2 – IITT 1.1.b, 1.1.c, 1.2.a

CLO 1.3 *Describe*, *analyze*, and *critique* the roles and impacts of human activity and digital technologies on humans, society, and the environment past, present, and future. ELO 3.1, 3.2

CLO 1.4 *Model* data collection, analysis, interpretation of results, and effective communication of the results to farmers/workforce that helps them to plan efficient farm operations. ELO 1.1, 1.2 – IITT 1.1.b, 1.1.c, 1.2.a

Course Goal 2. Successful students will integrate approaches to sustainability by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in the future.

CLO 2.1 *Compare* the technologies (Applied IoT, Artificial Intelligence, Blockchain, Controlled Environment Agricultures, Data Mining, Enterprise Agriculture, On-Farm Research, Variable Rate Application, RFID) used in digital agriculture and food systems as they have an impact on sustainability, environment, and society in the world around us. ELO 2.1 – IITT 2.1.a

CLO 2.2 *Evaluate* the impact of digital agriculture [production, processing, and distribution systems (plant and livestock)] on sustainability under different disciplinary lenses, multi-cultural, diverse perspectives applied to complex sustainability concepts. ELO 2.1 – IITT 2.1.b

CLO 2.3 *Examine* how **your understanding** of sustainability concepts, scholarly approach, and knowledge has changed since the beginning of the course. ELO 2.2 – IITT 2.2.a

CLO 2.4 Using the sustainability concepts ***Create* your own definition** of, and the role of digital agriculture then *Create* a second definition and role from a different person's perspective. *Evaluate* the similarities and differences based on the two perspectives. ELO 2.2 – IITT 2.2.b

CLO 2.5 *Categorize and Compare* how digital agriculture uses intelligent networks and data management on the data that is generated, stored, has ownership, privacy, security, ethics, and technologies influence sustainability (plant, animal, and soil environments). ELO 1.2, 2.1 – IITT 1.2.a, 2.1.a

How This Course Works

Mode of delivery: In Person

There are required classes Tuesday and Thursdays, 9:35 a.m.-10:55 a.m. The rest of your work is found in Carmen and can be completed around your own schedule during the week. Fifteen lectures will be co-led by individual instructors (seven from FABE an eight from HCS) to allow for integration of content presented in previous and current sessions. Thirteen lectures will be led by individual instructors to discuss their disciplinary expertise.

Pace of activities:

This course is divided into **weekly modules**. Students are expected to keep pace with weekly deadlines but may schedule their efforts freely within that time frame.

Credit hours and work expectations: This is a 4 credit-hour multi-disciplinary team-taught course.

According to Ohio State bylaws on instruction (go.osu.edu/credit hours), students should expect around 3 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to 6 hours of homework activities (reading and assignment preparation, for example) to receive a grade of C average.

Please note: This includes studying, reviewing, and editing notes, discussing with fellow students, etc. and does not equate to assignments and homework activities.

Attendance and participation requirements:

Research shows regular participation is one of the highest predictors of success. With that in mind, the instructor has the following expectations for everyone's participation:

- **Attendance:** You are expected to attend all classes.
- **Participation:** Your participation in class is essential to your success. Participation includes Answering questions in class when called upon; sharing relevant insights of examples from your experiences; Asking questions if you do not understand the material.
- In case of emergencies and other circumstances that prevent you from attending, please contact the instructor as soon as possible by email. Official documentation (e.g., from a doctor's office or hospital, or interviewer, etc.) must be provided. If you miss a lab session, please discuss how to make up the lab with the instructor in a different time.

Course Materials, Fees, and Technologies

Required Materials and/or Technologies.

The following are general textbooks which will provide background information. Specific chapters from these and other textbooks may be assigned by the instructors.

All materials are available from the OSU library free of cost. Off-campus access to most OSU Library resources may be obtained through these routes.

- **[DAS]** Marçal de Queiroz, Daniel, et al., editors. *Digital Agriculture*. Springer, 2022. https://library.ohio-state.edu/record=b10547384~S7

- **[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). Precision agriculture basics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375
- **[WPA]** Hamrita, T. K. (Ed.). (2021). Women in precision agriculture: technological breakthroughs, challenges and aspirations for a prosperous and sustainable future (Ser. Women in engineering and science). Springer. https://osu.on.worldcat.org/oclc/1187169922 https://ebooks.ohiolink.edu/viewer/e7ec4ef2-6500-11eb-af00-0a9b31268bf5/1

  In addition, journal articles will be assigned from time to time by the instructors and will be posted to CarmenCanvas.

- Computer: current Mac (OS X) or PC (Windows 10) or higher with high-speed internet connection
- Webcam: built-in or external webcam, fully installed and tested
- Microphone: built-in laptop or tablet mic or external microphone

Recommended/Optional Materials and/or Technologies.

- The instructors will provide you with supplementary reading materials periodically and will be announced during the lecture. They will be uploaded to CarmenCanvas.
- The course instructors will update additional material/sources for students during individual lectures. Digital agriculture area is dynamic and new research is published on an ongoing basis. Instructors will be interacting with Dr. Florian Diekman, science liaison librarian, throughout the semester. He serves as Head of the Food, Agricultural, and Environmental Sciences Library at The Ohio State University. Florian provides research and teaching support for the students, faculty, staff, and alumni of the College of Food, Agricultural, and Environmental Sciences, and members of the public.
  - **[TRB]** Crawley, M. J. (2013). The R book (Second). Wiley. Retrieved July 21, 2022, https://osu.on.worldcat.org/oclc/809365744
  - [OAG] *Ohio Agronomy Guide 15th Edition, Bulletin 472* | *Agronomic Crops Network*. https://agcrops.osu.edu/publications/ohio-agronomy-guide-15th-edition-bulletin-472. Accessed 21 Dec. 2022.
  - [EBS] *EBarns – Putting Data in Producers' Hands | Ohio BEEF Cattle Letter*. https://u.osu.edu/beef/2022/08/24/ebarns-putting-data-in-producers-hands/. Accessed 21 Dec. 2022.
  - [EFS] *EFields On-Farm Research* | *Digital Ag*. https://digitalag.osu.edu/efields. Accessed 21 Dec. 2022.

Fees and/or Additional Requirements

- None

Required Equipment

- **Computer:** current Mac (MacOS) or PC (Windows 10) with high-speed internet connection
- **Webcam:** built-in or external webcam, fully installed and tested
- **Microphone:** built-in laptop or tablet microphone or external microphone
- **Other:** a mobile device (smartphone or tablet to use for BuckeyePass authentication

If you do not have access to the technology you need to succeed in this class, review options for technology and internet access at go.osu.edu/student-tech-access.

You can use any electronic device to access the course in CarmenCanvas and perform all of the function needed to complete the course. There may be additional directions or restrictions for some of the activities as noted in those activities.

Required Software

- Microsoft Office 365**:** All Ohio State University students are now eligible for free Microsoft Office 365 ProPlus through Microsoft's Student Advantage program. Full instructions for downloading and installation is found Office 365 - Installation of Office for Windows/Mac for Students.
- Zotero**:** You also need to install the ASABE style by going to Zotero Style Repository then select American Society of Agricultural and Biological Engineers or, ZoteroBib to build bibliography without downloading the app and style. Instructions are found ZoteroBib FAQ.
- **ArcGIS Desktop**: Will be used in the labs and you need to download it to a Windows machine from go.osu.edu/esri. Go to the ArcGIS Desktop Get started with ArcMap and follow the instructions.
- "R"- **What is R?** You will be using R in lab for statics. You can download R for free from the R Project for Statistical Computing using a USA CRAN server such as Case Western Reserve University Mirror.

CarmenCanvas Access

You will need to use BuckeyePass (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you do each of the following:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device (go.osu.edu/add-device) help article for step-by-step instructions.
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Install the Duo Mobile application (go.osu.edu/install-duo) on all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357 (HELP) and IT support staff will work out a solution with you.

Technology Skills Needed for This Course

- Basic computer and web-browsing skills
- Basic knowledge of statistics (from prerequisites)
- Navigating CarmenCanvas (go.osu.edu/canvasstudent)
- CarmenZoom virtual meetings (go.osu.edu/zoom-meetings)
- Recording a slide presentation with audio narration and recording, editing, and uploading video (go.osu.edu/video-assignment-guide

Technology Support

For help with your password, university email, CarmenCanvas, or any other technology issues, questions, or requests, contact the IT Service Desk, which offers 24-hour support, seven days a week.

- **Self Service and Chat**: go.osu.edu/it

- **Phone:** 614-688-4357 (HELP)
- **Email:** servicedesk@osu.edu

Grading and Faculty Response

How Your Grade is Calculated

Assignment Category	Percentage
Guest Speaker Reflections (3), Homeworks (7), and Discussions	**5%**
Quizzes (6)	**5%**
Technical Feasibility and Sustainability Study (1)	**20%**
Laboratories (14)	**20%**
Exams (2) (15% each)	**30%**
Final Exam (1)	**20%**
Total	**100%**

See Course Schedule for due dates.

Descriptions of Major Course Assignments

Description: During the semester, you will complete various assignments (Discussion Post, Homework, Guest Speaker Reflections), Quizzes, a Technical Feasibility and Sustainability Study, Exams, and Final Exam. Assignments may not be turned in after the due date (not counting excused absences). If an exception is not made, they will be penalized 20% for each day late. Persons with excused absences (verified illness, academic conflict) may in some cases be able to make up the material. In these cases, if it is not feasible to duplicate a missed assignment, the assignment will not be factored into the final grade. Specific course requirements are listed next. **See page 16 for the Late Assignment Policy.**

Discussions, Guest Speaker Reflections, and Homework will count for 10% of your final grade.

Discussion

Non-Graded – General Discussions about the course, questions to the instructors, and normal course operations.
Graded –

- Technical Feasibility and Sustainability Study video discussions: Post and comment on another student's video

- Students will Post weekly to the following:
  - Student Reflections – work on definitions, technology, basic science, and process.
  - Student Journals for students to reflect on their learning in a private space.

  Goal 2 [CLO 2.3 (ELO 2.2 – IITT 2.2.a), ELO 2.2 – IITT 2.2.b]

Homework (HWK)

Students will have homework to complete. Be sure to understand the specifics of the homework and respond accordingly. A total of seven (7) Homework exercises will be given during the entire duration of the course.

We are training you to become professionals. With this in mind, your work should be of high quality. **For each homework, we will provide you with a specific rubric relevant to the assigned homework**. **Partial credit will be given.**

Here are some examples of HWKs titles

HWK 1 – Sustainable Production Systems
HWK 2 – Social Media As a "Knowledge Tool" For Sustainable Food Production
HWK 3 – Conferences. as a "Knowledge Tool" for Digital Agriculture
HWK 4 – Data Interoperability in Sustainable Digital Agriculture
HWK 5 – Google Earth Engine (GEE) and its applications
HWK 6 – Ethics of Data Ownership
HWK 7 – Sustainability-Digital Agriculture: Thought Leader Changes Across the Semester

Sample Homework Rubric	
Grading Scale 4-point scale – 4 (exceeds expectations - >90%), 3 (meets expectations - 80-90%), 2 (meets $^{2}/_{3}$ of the expectations 70-80%), 1 (meets $^{1}/_{3}$ of the expectations - 60-70%), and 0 (unsatisfactory - <60%)	**Score**
Homework Requirements	**0 to 4 pts.**
A. Write out the objective of the homework, do not include any irrelevant details	
B. Demonstrate thorough understanding of topic using complete and accurate information	
C. Present information in a knowledgeable manner	
D. Use three or more referenced resources to gather information including speaking with stakeholders and experts	
E. Use appropriate resources (peer reviewed publications, trade publications, websites, videos etc. using the ASABE Style Guide	
Subtotal	
Homework Organization	**0 to 4 pts.**
1. Visual appeal and clarity, figures and maps are neatly done with proper labeling	
2. Legible, neatness, and creativity	
3. Homework is complete and on time	
4. Successfully meet the objective(s) of the homework	
5. Written homework without any typos and clearly written	
Subtotal	
Total (0 to 40 pts.)	

Guest Speaker Reflections

Invited Guest Speakers are experts in digital agriculture and its impact on digital agriculture. They will provide real world data and their experience with sustainability and digital agriculture. A tentative list of guest speakers will be compiled with input and feedback from the instructors involved in teaching the course. In the first lecture, the instructor will share the list with the students and ask for their feedback. If they suggest a guest speaker that they would like to invite, the instructor will work the students and invite that guest speaker if they are available.

Each Outside Expert will answer structured questions [1] Self-introduction: background, education, & current position; current responsibilities and career path that led to the current position; [2] provide a definition of digital agriculture based on your experience; [3] three significant events/technologies shaping digital agriculture at present. [4] three possible events/technologies in the future that could change the face of digital agriculture; [5] current and future job opportunities for graduates with digital agriculture background in their company; [6] education and skill set required for graduates to be employed in the digital agriculture sector) in addition to questions from the students. Students will attend three (3) presentations and participate in question-and-answer (Q & A) sessions. They will write a report on the guest speakers' presentation. Students will write a 400 to 800 words report by providing their comments on the presentation and Q & A session. The report will be graded based on the rubric developed for the guest speaker reflections assignment. The report is designed to elicit the student's views, a critique of the experts' presentation in relation to the impact on them as an individual and on agricultural production, the environment/sustainability, and society (local, national, global).

Sustainability Concepts

Carbon Cycling and Sequestration
Climate-Smart Agriculture
Food Safety
Food Security
Food Production Optimization and Efficiency
Nitrogen and Phosphorus Cycling and Use Efficiency
Water Quality and Quantity

Goal 1 [CLO 1.1 (ELO 1.1, 3.3 – IITT 1.1.a), CLO 1.2 (ELO 1.1, 1.2 – IITT 1.1.b, 1.1.c, 1.2.a), CLO 1.3 (ELO 3.1, 3.2), CLO 1.4 (ELO 1.1, 1.2 – IITT 1.1.b, 1.1.c, 1.2.a)]
Goal 2 [CLO 2.1 (ELO 2.1 – IITT 2.1.a), CLO 2.2 (ELO 2.1 – IITT 2.1.b), CLO 2.5 (ELO 1.2, 2.1 – IITT 1.2.a, 2.1.a)]

Technical Feasibility and Sustainability Study (TFSS):

The objective of this assignment is to understand the implications of technology and its potential for adoption. You will develop a feasibility study document highlighting the implications of adopting a new technology or a practice. You should provide a thoughtful analysis of how this technology will affect the private sector (disruption, profitability, consolidation/decentralization, vertical integration, etc.) based on your review of the existing literature and/or other sources of information. Imagine a company has approached you and you are responsible for putting together a feasibility study about a product/technology they desire to purchase or develop. Will this be a sound investment for the company, and what if there any concerns should they be aware of regarding the regulatory landscape as well as social implications? A detailed rubric will be provided.

The Technical Feasibility and Sustainability Study will count for 20% of your final grade and *Draft* and *Final* should be ten (10) pages in length (11 pt. font, double spaced, and inclusive of figures). It should include the

following sections: Introduction, Explanation of technology or practice, Meaningful insights about the technical feasibility, relevance, and credibility of the technology, Factors affecting adoption of the technology, Growth/adoption potential for proposed technology, Impact of the technology on Sustainability concepts. Recommendations to improve technology adoption, Economic benefits of technology adoption and Creative visual presentation of data/information is encouraged. Due Week 13.

You will create a 90 to 120 sec video about your study and post it to the TTSS Discussion board and you will present your study in class during Week 15.

Goal 1 [CLO 1.1 (ELO 1.1, 3.3 – IITT 1.1.a); CLO 1.2 (ELO 1.1, 1.2 – IITT 1.1.b, 1.1.c, 1.2.a), CLO 1.3 (ELO 3.1, 3.2, CLO 1.4 (ELO 1.1, 1.2 – IITT 1.1.b, 1.1.c, 1.2.a)]
Goal 2 [CLO 2.1 (ELO 2.1 – IITT 2.1.a), CLO 2.2 (ELO 2.1 – IITT 2.1.b), CLO 2.3 (ELO 2.2 – IITT 2.2.a), CLO 2.4 (ELO 2.2 – IITT 2.2.b), CLO 2.5(ELO 1.2, 2.1 – IITT 1.2.a, 2.1.a)]

Technical Feasibility and Sustainability Study (TFSS) Sections and Due Dates

All sections should be 11 pt. font, double-spaced.

1. 5 pts – **Topic title Due Week 2** No rubric
2. 5 pts – **Class presentation, video, and discussion of the video TBA**
3. 15 pts – **Introduction (200+ words)** and relevance of the topic **Due Week 4.** Use the Introduction Section in the Technical Feasibility and Sustainability Study Rubric below.
4. 15 pts– **References and Information Sources** Background and literature sources **Due Week 6** Use the References and Information Sources Section in the Rubric below.
5. 20 pts – **Draft** – **Due Week 11** Use Technical Feasibility and Sustainability Study Rubric below
6. 40 pts – Final version of the Technical Feasibility and Sustainability Study **Due Week 14** Use Technical Feasibility and Sustainability Study Rubric below
   The rubric below is used for grading the draft and the final version. Total 100 pts for Technical Feasibility and Sustainability Study

Technical Feasibility and Sustainability Study Rubric *[Draft points]* (Final points)

Performance Indicator	Exceeds Expectations *[4-6]* (9-12 pts)	Meets Expectations *[2-3]* (6-9 pts)	Partially Meets Expectations *[1-2]* (3-6 pts)	Unsatisfactory *[0-1]* (0-3 pts)	Possible Points
Introduction	Thoroughly, but concisely introduces sustainability effects of the technology/practice and excellent understanding of the technology.	Introduction sufficient, but slightly flawed.	Little introductory information; flawed and incomplete understanding of the technology.	Poorly stated or missing introductory information.	*[6]* **(12)** pts

A G S Y S M T / H C S 3 5 8 6
Digital Agriculture

Performance Indicator	Exceeds Expectations *[4-6]* (9-12 pts)	Meets Expectations *[2-3]* (6-9 pts)	Partially Meets Expectations *[1-2]* (3-6 pts)	Unsatisfactory *[0-1]* (0-3 pts)	Possible Points
Technology and Sustainability Description	Well-defined, clear description; supported by research that thoroughly, but concisely defines requirements.	Technology description sufficient; not stated in clear, concise manner; supported by research defines requirements.	Poor technology description; not stated in clear, concise manner; supported by research.	Flawed and/or incomplete understanding of the technology; not stated in clear, concise manner; no supporting research.	*[6]* **(12)** pts
Background and Relevance	Thoroughly, but concisely describes background and relevance information; excellent understanding of the sustainable technical topic and foundational information.	Background and relevance information sufficient, but slightly flawed.	Little background and relevance information; flawed and incomplete understanding of the technical topic.	Poorly stated or missing background and relevance information.	*[6]* **(12)** pts
Considerations for Adoption	Well-defined considerations for adoption; answers market potential; well-documented and clear sustainability and technical considerations.	Considerations for adoption are sufficient, may lack creativity; addresses market potential; well documented.	Considerations for adoption lack creativity; partially addresses market potential; adequate documentation.	Considerations for adoption are lacking; do not address market potential; no creativity; poorly documented.	*[6]* **(12)** pts
Economic Sustainability and Social Acceptance Analyses	Excellent, well-documented economic sustainability and social acceptance analyses.	Sound economic sustainability and social acceptance analyses.	Flawed and/or incomplete economic sustainability and social acceptance analyses.	Poorly developed economic sustainability and social acceptance analyses; do not meet minimal expectations.	*[6]* **(12)** pts

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Performance Indicator	Exceeds Expectations *[4-6]* (9-12 pts)	Meets Expectations *[2-3]* (6-9 pts)	Partially Meets Expectations *[1-2]* (3-6 pts)	Unsatisfactory *[0-1]* (0-3 pts)	Possible Points
Final Recommendation	Definitive system solution recommendation, cost effective and well supported by thoughtful and complete analyses.	Sound system solution recommendation, is cost effective and supported by thoughtful analyses.	Flawed and/or incomplete system solution recommendation, biased towards a particular solution which is not supported by analyses.	Unclear recommendation; poorly support – lacking system(s) analyses and comparison of alternatives.	*[4]* **(8)** pts
Organization	Organization pattern is logical and conveys completeness and wholeness.	Organization pattern is logical and conveys completeness and wholeness with few lapses.	Attempt at organization, but little sense of wholeness and completeness.	Ad-hoc structure, little evidence of organization, little or no sense of wholeness and completeness.	*[4]* **(8)** pts
Grammar/Style	Consistently follows the rules for standard English. Uses effective language, makes engaging, appropriate word choices for audience/ purpose.	Generally, follows the rules for standard English. Uses effective language and appropriate word choices for intended audience/ purpose.	Generally, does not follow the rules of standard English. Limited and predictable vocabulary, perhaps not appropriate for intended audience/ purpose.	Does not follow rules of standard English. Limited or inappropriate vocabulary for the intended audience and purpose.	*[4]* **(8)** pts
Figures and Tables	Figures and tables always support the text and are well designed.	Figures and tables generally support the text and are usually well designed.	Figures and tables sometimes support the text, and sometimes well designed.	Figures and tables do not support the text or are poorly designed.	*[4]* **(8)** pts
References and Information Sources	References and other sources of information cited for material used in the report. All sources support the discussion.	References and other sources of information cited for material used in the report. Most of the sources are appropriate to support the discussion.	References and other sources of information not cited for some material used in the report, or inappropriate sources cited.	References and other sources of information consistently not cited for material used in report.	*[4]* **(8)** pts

Quizzes – Biweekly (selected questions may also be used in Exams)

40 questions (true/false 20 at 1 points each, multiple choice 20 2 points each)
Given in Carmen, 3 attempts – highest score, Open Book Open Notes
Quizzes covering lecture material and reading assignments will count for 10% of your final grade.
Goal 1 [CLO 1.1 (ELO 1.1, 3.3 – IITT 1.1.a); CLO 1.2 (ELO 1.1, 1.2 – IITT 1.1.b, 1.1.c, 1.2.a), CLO 1.3 (ELO 3.1, 3.2, CLO 1.4 (ELO 1.1, 1.2 – IITT 1.1.b, 1.1.c, 1.2.a)]
Goal 2 [CLO 2.1 (ELO 2.1 – IITT 2.1.a), CLO 2.2 (ELO 2.1 – IITT 2.1.b), CLO 2.3 (ELO 2.2 – IITT 2.2.a), CLO 2.4 (ELO 2.2 – IITT 2.2.b), CLO 2.5(ELO 1.2, 2.1 – IITT 1.2.a, 2.1.a)]

Exams (refer to the schedule)

Fifty (50) questions each (true/false, multiple choice)
Given in Carmen, 1 attempt, Closed Book and Notes
Two Exams covering reading and lecture materials will count for 20% X 2 for 40%

Exam 1 – [ELO 1.1, 1.2, 2.1, 2.2, 3.1, 3.2, 3.3 – IITT 1.1.a, 1.1.b, 1.1.c, 1.2.a, 2.1.a, 2.1.b, 2.2.b]
Goal 1 [CLO 1.1 (ELO 1.1, 3.3 – IITT 1.1.a); CLO 1.2 (ELO 1.1, 1.2 – IITT 1.1.b, 1.1.c, 1.2.a), CLO 1.3 (ELO 3.1, 3.2)]
Goal 2 [CLO 2.1 (ELO 2.1 – IITT 2.1.a), CLO 2.2 (ELO 2.1 – IITT 2.1.b), CLO 2.3 (ELO 2.2 – IITT 2.2.a)]

Exam 2 – [ELO 1.1, 1.2, 2.1, 3.1, 3.2, 3.3 – IITT 1.1.a, 1.1.b, 1.1.c, 1.2.a, 2.1.a]
Goal 1 [CLO 1.1 (ELO 1.1, 3.3 – IITT 1.1.a); CLO 1.2 (ELO 1.1, 1.2 – IITT 1.1.b, 1.1.c, 1.2.a), CLO 1.3 (ELO 3.1, 3.2), CLO 1.4 (ELO 1.1, 1.2 – IITT 1.1.b, 1.1.c, 1.2.a)]
Goal 2 [CLO 2.1 (ELO 2.1 – IITT 2.1.a); CLO 2.4(ELO 2.2 – IITT 2.2.b); CLO 2.5 (ELO 1.2, 2.1 – IITT 1.2.a, 2.1.a)]

Final Exam (refer to the schedule)

50 questions each (true/false, multiple choice)
Given in Carmen, 1 attempt, Closed Book and Notes
A comprehensive final exam will be administered at the end of the semester during the regularly scheduled final exam period. You will be given sample questions during the last week of class. The final exam will count for 20% of your final grade.

ELO 1.1, 1.2, 2.1, 2.2, 3.1, 3.2, 3.3 IITT 1.1.a, 1.1.b, 1.1.c, 1.2.a, 2.1.a, 2.1.b, 2.2.a, 2.2.b

Goal 1 [CLO 1.1 (ELO 1.1, 3.3 – IITT 1.1.a); CLO 1.2 (ELO 1.1, 1.2 – IITT 1.1.b, 1.1.c, 1.2.a), CLO 1.3 (ELO 3.1, 3.2, CLO 1.4 (ELO 1.1, 1.2 – IITT 1.1.b, 1.1.c, 1.2.a)]
Goal 2 [CLO 2.1 (ELO 2.1 – IITT 2.1.a), CLO 2.2 (ELO 2.1 – IITT 2.1.b), CLO 2.3 (ELO 2.2 – IITT 2.2.a), CLO 2.4 (ELO 2.2 – IITT 2.2.b), CLO 2.5(ELO 1.2, 2.1 – IITT 1.2.a, 2.1.a)]

Descriptions of Laboratory Course Assignments

Description: There are 14 Laboratory Report each with a procedure, objectives, data, and results. There is a rubric for each Laboratory Report. **See page 19 for the Late Assignments.**

Goal 1 [LLO 1.1 (ELO 1.1, 3.3 – IITT 1.1.a); LLO 1.2 (ELO 1.1, 1.2 – IITT 1.1.b, 1.1.c, 1.2.a); LLO 1.3 (ELO 3.1, 3.2); LLO1.4 (ELO 1.1, 1.2 – IITT 1.1.b, 1.1.c, 1.2.a)]
Goal 2 [LLO 2.1 (ELO 2.1 – IITT 2.1.a); LLO 2.2 (ELO 2.1 – IITT 2.1.b); LLO 2.3 (ELO 2.2 – IITT 2.2.a); LLO 2.4 (ELO 2.2 – IITT 2.2.b); LLO 2.5 (ELO 1.2, 2.1 – IITT 1.2.a, 2.1.a)]

Sample Grading Rubric for Laboratory Reports

General Laboratory Report Rubric	
Grading Scale 4-point scale – 4 (exceeds expectations - >90%), 3 (meets expectations - 80-90%), 2 (meets $^{2}/_{3}$ of the expectations 70-80%), 1 (meets $^{1}/_{3}$ of the expectations - 60-70%), and 0 (unsatisfactory - <60%)	**Score**
Report Requirements	**0 to 4 pts.**
F. Write out the objective of the report, do not include any irrelevant details	
G. Demonstrate thorough understanding of topic using complete and accurate information	
H. Present information in a knowledgeable manner	
I. Use three or more referenced resources to gather information including speaking with stakeholders and experts	
J. Use appropriate resources (peer reviewed publications, trade publications, websites, videos etc. using the ASABE Style Guide	
Subtotal	
Report Organization	**0 to 4 pts.**
1. Visual appeal and clarity, figures and maps are neatly done with proper labeling	
2. Legible, neatness, and creativity	
3. Homework is complete and on time	
4. Successfully meet the objective(s) of the assignment	
5. Written assignment without any typos and clearly written	
Subtotal	
Total (0 to 40 pts.)	

Grading Scale

Grade	Range
A	100 % to 93.0%
A-	< 93.0 % to 90.0%
B+	< 90.0 % to 87.0%
B	< 87.0 % to 83.0%
B-	< 83.0 % to 80.0%
C+	< 80.0 % to 77.0%
C	< 77.0 % to 73.0%
C-	< 73.0 % to 70.0%
D+	< 70.0 % to 67.0%
D	< 67.0 % to 60.0%
E	< 60.0 % to 0.0%

Academic integrity and collaboration:

Quizzes

You must complete the quizzes yourself, using your notes. Quizzes will be based on the announced content/readings/weeks/lectures.

Exams

You must complete the final exam yourself, without any external help or communication.

Written Assignments

Your written assignments, including discussion posts, should be your own original work. In formal assignments, you should follow ASABE style to cite the key words and references. You are encouraged to ask a trusted person to proofread your assignments before you turn them in--but no one else should revise or rewrite your work.

Reusing Past Work

In general, you are prohibited in university courses from turning in work from a past courses to your current class, even if you modify it. If you want to build on past research or revisit a topic you have explored in previous courses, please discuss the situation with instructor.

Falsifying Research or Results

All research that you will conduct in this course is intended to be a learning experience; you should never feel tempted to make your results or your library research look more successful than it was.

Collaboration and Informal Peer-Review

The course includes many opportunities for formal collaboration with your classmates. While study groups and peer-review of major written projects is encouraged, remember that comparing answers on a quiz or assignment is not permitted. If you are unsure about a particular situation, please feel free just to ask ahead of time.

Late Assignments

Please refer to Carmen for due dates. Due dates are set to help you stay on pace and to allow timely feedback that will help you complete subsequent assignments.

- For the Homework or Guest Speaker Reflections you may drop a total of two of the lowest score of two (except as noted in the Evaluation section).
- Late work will have 20% of the total points deleted for each day it is late. Five (5) days late you will receive zero (0 points). This is based on the timestamp in Carmen, anything after the deadline is the next day and 20% off. In the case of documented emergency or illness, please contact the Course Coordinator as soon as possible to discuss accommodation, which will be determined on a case-by-case basis.

Instructor Feedback and Response Time

I am providing the following list to give you an idea of my intended availability throughout the course. Remember that you can call 614-688-4357 (HELP) at any time if you have a technical problem.

- **Preferred contact method:** If you have a question, please contact me first through my Ohio State email address. I will reply to emails within **24 hours on days when class is in session at the university**.
- I am providing the following list to give you an idea of my intended availability throughout the course. Remember that you can call 614-688-HELP at any time if you have a technical problem.
- **Class announcements:** I will send all important class-wide messages through the Announcements tool in CarmenCanvas. Please check your notification preferences (go.osu.edu/canvas-notifications) to ensure you receive these messages.
- **Discussion board:** I will check and reply to messages in the discussion boards once mid-week and once at the end of the week.
- **Grading and feedback:**
    - Instructors will share grading duties and base scoring on defined criteria.
    - For large weekly assignments, you can generally expect feedback within 7 working days.
    - For exams, you can generally expect feedback within 2 weeks.

Other Course Policies

Discussion and Communication Guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- Writing style: While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics.
- Tone and civility: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online. I will provide specific guidance for discussions on controversial or personal topics.
- Citing your sources: When we have academic discussions, please cite your sources to back up what you say. For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.
- Backing up your work: Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion.

Academic Integrity Policy

See Descriptions of Major Course Assignments for specific guidelines about collaboration and academic integrity in the context of this class.

Ohio State's Academic Integrity Policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM expect that all students have read and understand the university's Code of Student Conduct (studentconduct.osu.edu), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to plagiarism), collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If we suspect that a student has committed academic misconduct in this course, we are obligated by university rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the university's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.
If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity to which you can refer include:

- Committee on Academic Misconduct (go.osu.edu/coam)
- Ten Suggestions for Preserving Academic Integrity (go.osu.edu/ten-suggestions)
- Eight Cardinal Rules of Academic Integrity (go.osu.edu/cardinal-rules)

Copyright for Instructional Materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Creating an Environment Free from Harassment, Discrimination, and Sexual Misconduct

The Ohio State University is committed to building and maintaining a community to reflect diversity and to improve opportunities for all. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate on the basis of age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also have the right to be free from all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Office of Institutional Equity:

1. Online reporting form at equity.osu.edu,
2. Call 614-247-5838 or TTY 614-688-8605,
3. Or email equity@osu.edu

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university employees have reporting responsibilities to the Office of Institutional Equity to ensure the university can take appropriate action:

- All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.
- The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member.

Counseling and Consultation Services/Mental Health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. No matter where you are engaged in learning, The Ohio State University's Student Life Counseling and Consultation Service (CCS) is here to support you. If you find yourself feeling isolated, anxious, or overwhelmed, on-demand mental health resources (go.osu.edu/ccsondemand) are available. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at 614- 292-5766**. 24-hour emergency help** is available through the 24/7 National Suicide Prevention Lifeline website (suicidepreventionlifeline.org) or by calling 1-800-273-8255(TALK). The Ohio State Wellness app (go.osu.edu/wellnessapp) is also a great resource.

For CFAES students they can contact David Wirt, wirt.9@osu.edu, is the CFAES embedded mental health counselor. He is available for new consultations and to establish routine care. To schedule with David, please call 614-292-5766. Students should mention their affiliation with CFAES when setting up a phone screening.

Accessibility Accommodations for Students with Disabilities

Requesting Accommodations

The university strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability including mental health, chronic or temporary medical conditions, please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services (SLDS). After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. In light of the current pandemic, students

seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services.

Disability Services Contact Information

- Phone: 614-292-3307
- Website: slds.osu.edu
- Email: slds@osu.edu
- In person: Baker Hall 098, 113 W. 12th Avenue

Accessibility of Course Technology

This course requires use of CarmenCanvas Ohio State's learning management system and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations as early as possible.

- CarmenCanvas accessibility (go.osu.edu/canvas-accessibility)
- Streaming audio and video
- CarmenZoom accessibility (go.osu.edu/zoom-accessibility)
- Overview of Accessibility at OSU and OSU Privacy

Specific course software's accessibility privacy statements

Vendor Accessibility	Vendor Privacy
Carmen (Canvas accessibility)	Carmen (Canvas/Infrastructure Privacy)
CarmenZoom accessibility	CarmenZoom Privacy
Adobe Connect (Carmen Connect Accessibility)	Adobe Privacy Policy
MediaSite Accessibility Statement	MediaSite Privacy
Microsoft Office Accessibility	Microsoft Office 365 Privacy
Proctorio Accessibility	**Proctorio Privacy**
Top Hat Accessibility	**Top Hat Privacy**

Course Schedule

Refer to the CarmenCanvas course for up-to-date deadlines. (XXX indicates textbook, A-YYY indicates articles)

Lecture#	Week	Topics, Readings, Assignments	Assignments, Assessments	Learning Outcomes	Instructor	Readings
1	**1**	Introduction to Digital Agriculture and its Role in Sustainability		CLO 1.1, CLO 1.2, CLO 1.3, CLO 2.4	FABE Lead HCS Lead	DAS Chap 1 PAB Chap 1 WPA Chap 1.2.3
2	**1**	Global Navigation Satellite Systems (GNSS) in Agriculture and Natural Resource Conservation		CLO 1.1	FABE Lead	DAS Chap 2 PAB Chap 3
3	**2**	ArcGIS and Applications in Agricultural Sustainability	**HWK 1**	CLO 1.1, CLO 1.3, CLO 2.4, CLO 2.5	FABE Lead HCS Lead	DAS Chap 3 PAB Chap 4
4	**2**	Farm Management Information Systems (FMIS) for Sustainable Management	**TFSS Topic Title**	CLO 1.2, CLO 1.3	FABE Lead HCS Lead	DAS Chap 15 PAB Chap 2,4,7,11 WPA Chap 1,2 A-CCS-2 A-CCS-9 A-FPO-4 A-FPO-5
5	**3**	Variable Rate Technology and its Role in Long-Term Soil Health and Sustainability	**Quiz 1**	CLO 1.1, CLO 1.3, CLO 1.4, CLO 2.1, CLO 2.4	FABE Lead HCS Lead	DAS Chap 9 PAB Chap 2,7,11 WPA Chap 1,2 A-CCS-3 A-CCS-6 A-WQQ-4 A-WQQ-7 A-WQQ-9 A-FPO-4 A-FPO-5
6	**3**	Soil Health Soil Sampling and Soil Sensing	**Guest Speaker Reflection 1**	CLO 1.1, CLO 2.4, CLO 2.5	HCS Lead	DAS Chap 6 PAB Chap 6 WPA Chap 3,4,5 A-CCS-6 A-CCS-10 A-WQQ-4 A-WQQ-9

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Lecture#	Week	Topics, Readings, Assignments	Assignments, Assessments	Learning Outcomes	Instructor	Readings
7	**4**	Yield Monitoring Technologies for Optimal Resource Management	**HWK 2**	CLO 1.1, CLO 1.3, CLO 2.4, CLO 2.5	FABE Lead HCS Lead	DAS Chap 8
8	**4**	Historical Yield Data and its Implications for Sustainability	**TFSS Introduction**	CLO 1.1, CLO 1.3, CLO 2.5	FABE Lead	PAB Chap 12
9	**5**	Artificial Intelligence Primer	**Quiz 2**	CLO 2.1	FABE Lead	
10	**5**	Artificial Intelligence and Crop Care		CLO 2.1	FABE Lead HCS Lead	
11	**6**	Controller Area Networks (CAN) and Connected Machines	**HWK 3**	CLO 1.1, CLO 1.3, CLO 2.1, CLO 2.5	FABE Lead	PAB Chap 1o
12	**6**	The Ethics of Data Ownership, Aggregation, and Cloud Computing	**TFSS Reference and Information**	CLO 2.1, CLO 2.4, CLO 2.5	FABE Lead HCS Lead	WPA 1.2.4
13	**7**	Google Earth Applications in Production and Urban Agriculture	**Quiz 3 HWK 4**	CLO 1.1	FABE Lead	
14	**7**	Remote Sensing and Applications in Sustainable Agriculture	**Guest Speaker Reflection 2**	CLO 2.5	FABE Lead	DAS Chap 4 PAB Chap 8,9
15	**8**	Drone Applications in Sustainable Agriculture	**Exam 1**	CLO 1.1, CLO 2.5	FABE Lead HCS Lead	DAS Chap 7
16	**8**	Precision Conservation Management		CLO 2.5	FABE Lead	A-WQQ-4
17	**9**	Controlled Environment Agriculture	**Quiz 4**	CLO 1.1, CLO 2.5	FABE Lead HCS Lead	A-CCS-2 A-WQQ-4
18	**9**	Tracking Weather and Climate Change	**Guest Speaker Reflection 3**	CLO 2.5	HCS Lead	
	10	Spring Break				
	10	Spring Break				
19	**11**	Precision Livestock Farming Systems	**HWK 5**	CLO 1.1, CLO 2.5,	FABE Lead HCS Lead	DAS Chap 11 WPA 1,9
20	**11**	Managing Pasture Based Livestock Systems	**TFSS Draft**	CLO 1.2, CLO 2.5	HCS Lead	A-FPO-4 A-FPO-5
21	**12**	Crop and Animal Modeling		CLO 1.2, CLO 1.3, CLO 1.4	HCS Lead	A-FPO-4 A-FPO-5
22	**12**	Precision Irrigation and Controlled Drainage for Enhance Water Quality	**Quiz 5**	CLO 1.1, CLO 2.5	FABE Lead HCS Lead	DAS Chap 10 WPA Chap 6 A-FPO-5 A-WQQ-1
23	**13**	Internet of Things (IoT) and Sustainability	**HWK 6**	CLO 1.1, CLO 2.4	HCS Lead	DAS Chap 12

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Lecture#	Week	Topics, Readings, Assignments	Assignments, Assessments	Learning Outcomes	Instructor	Readings
24	**13**	On-Farm Research and its role in Digital Agriculture.	**TFSS Final**	CLO 1.1, CLO 1.4	FABE Lead HCS Lead	PAB Chap 13 A-CCS-6 A-FPO-4 A-FPO-5
25	**14**	Data Analytics and Visualization for Digital Agriculture		CLO 1.2, CLO 1.4	HCS Lead	DAS Chap 13 WPA 1
26	**14**	AI in Marketing and Agricultural Supply Chain Logistics	**Exam 2**	CLO 2.1, CLO 2.4	HCS Lead	
27	**15**	Application of Blockchain Technology in Agricultural Supply Chain	**Quiz 6** **TFSS Presentation**	CLO 2.5	HCS Lead	
28	**15**	Enterprise Agriculture and Sustainability	**HWK 7** **TFSS Presentation**	CLO 1.1, CLO 1.4, CLO 2.2	FABE Lead HCS Lead	PAB Chap 14,15 A-WQQ-4
		Finals	Final			

Laboratory Schedule

Lab/ Week No.	Due Date	Laboratory/ Exercises	CLO
1		Data-Driven Resource Allocation	CLO 1.1 CLO 1.2 CLO 1.3 CLO 2.1
2		ArcGIS Applications in Sustainable Agricultural Production	CLO 1.3 CLO 2.1
3		Variable Rate Technology and Soil Health	CLO 1.1 CLO 1.2 CLO 1.3 CLO 2.1
4		Yield Monitoring for Improved Resources Utilization	CLO 1.1 CLO 1.2 CLO 1.3 CLO 2.1
5		Data Infrastructure to Support Economic and Ecological Outcomes	CLO 1.1 CLO 1.2 CLO 1.3 CLO 2.1
6		Connected Machines and CAN Data	CLO 1.1 CLO 1.2 CLO 1.3 CLO 2.1
7		Google Earth Applications in Production and Urban Agriculture	CLO 1.2 CLO 1.3 CLO 2.1
8		Remote Sensing for Sustainability	CLO 1.2 CLO 1.3 CLO 2.1
9		Drones for Environmental Monitoring and Sustainability	CLO 1.1 CLO 1.2 CLO 1.3 CLO 2.1
10		Spring Break	
11		Mapping, Modeling, and Data Analytics using ArcGIS	CLO 1.1 CLO 1.2 CLO 1.3 CLO 2.1
12		Introduction to R and On-Farm Research	CLO 1.1 CLO 1.2 CLO 1.3 CLO 2.1
13		Role of Big Data in Sustainability	CLO 1.1 CLO 1.2 CLO 1.3 CLO 2.1
14		Supply Chain Management and Sustainability	CLO 1.1 CLO 1.2 CLO 1.3 CLO 2.1
15		Blockchain Applications for Traceability in the Food Supply Chain	CLO 1.2 CLO 1.3 CLO 2.1

Interdisciplinary Team-Taught Course Inventory

Overview

The GE allows students to take a single, 4+ credit course to satisfy a particular GE Theme requirement if that course includes key practices that are recognized as integrative and high impact. Courses seeking one of these designations need to provide a completed Integrative Practices Inventory at the time of course submission. This will be evaluated with the rest of the course materials (syllabus, Theme Course submission document, etc.). Approved Integrative Practices courses will need to participate in assessment both for their Theme category and for their integrative practice.

Please enter text in the boxes below to describe how your class will meet the expectations of Interdisciplinary Team-Taught courses. It may be helpful to consult the Description & Expectations document for this pedagogical practice or to consult your Director of Undergraduate Studies or appropriate support staff person as you complete this Inventory and submit your course.

Please use language that is clear and concise and that colleagues outside of your discipline will be able to follow. You are encouraged to refer specifically to the syllabus submitted for the course, since the reviewers will also have that document Because this document will be used in the course review and approval process, you should be *as specific as possible*, listing concrete activities, specific theories, names of scholars, titles of textbooks etc.

Accessibility

If you have a disability and have trouble accessing this document or need to receive it in another format, please reach out to Meg Daly at daly.66@osu.edu or call 614-247-8412.

Pedagogical Practices for Interdisciplinary Team-Taught Courses

Course subject & number **AGSYSMT/HCS 3586**

Performance expectations **set at appropriately high levels (e.g. Students investigate large, complex problems from multiple disciplinary perspectives).** Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

Students will investigate large complex problems from multiple disciplinary perspectives like Carbon Cycling and Sequestration, Climate Smart Agriculture, Food Production Optimization and Efficiency, Food Safety, Food Security, Nitrogen and Phosphorus Cycling and Use Efficiency, and Water Quality and Quantity which forms foundation for Sustainability in Digital Agriculture. Digital agriculture technologies produce large scale data sets. Large scale complex problems are used as examples throughout the entire course centered on food system operations (small holder vs corporate) that have an impact on sustainability. AGSYSMT/HCS 3586 (4 credits).

AGSYSMT_HCS 3585 3 credit without laboratories and AGSYSMT_HCS 3586 4 credit including laboratories.

For AGSYSMT_HCS 3586 4 credit - Laboratories will provide students an opportunity to work with these large-scale complex issues. Labs: L1- Data-Driven Resource Allocation, L3- Variable Rate Technology and Soil Health, L4- Yield Monitoring for Improved Resources Utilization, L5- Connected Machines and CAN Data, L6- Data Infrastructure to Support Economic and Ecological Outcomes, L8- Remote Sensing for Sustainability, L9- Drones for Environmental Monitoring and Sustainability, L11- Introduction to R and On-Farm Research, L12- Role of Big Data in Sustainability, L14- Blockchain Applications for Traceability in the Food Supply Chain.

The Guest Speaker Reflections address how technology impacts food, fuel, fiber, energy production practices, logistics, careers (current and future), profitability, sustainability, the environmental issues, and effective ways to communicate with stakeholders and experts. The Technical Feasibility and Sustainability Study focuses on the implication of a new technology or practices on sustainability and its potential for adoption. Students will provide a thoughtful analysis of how technology will impact sustainability, and role of private sector in developing new sustainable technologies based on a review of the existing literature and/or other external sources of information.

Significant investment of time and effort by students over an extended period of time (e.g., engage the issue iteratively, analyzing with various lenses and seeking to construct an integrative synthesis). Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

The 1) Technical Feasibility and Sustainability Study, 2) Guest Speaker Reflections, and 3) Laboratory Activities (AGSYSMT_HCS 3586 only) provide students with opportunities to revisit, analyze, and synthesize the material taught in the course. Students can compare their knowledge and understand the complex issues of data driven food, fuel, and fiber production systems and reflect on how their knowledge and understanding has changed over the semester. Each of the three above activities span the semester and the students have the option to pursue their interest in sustainability. The Technical Feasibility and Sustainability Study looks at adopting new data-driven technologies and production practices. Guest Speaker Reflections provides students with the current state of data driven food systems and possible career opportunities in the area of sustainable digital agriculture. Planned laboratory activities provide hands on experience to the students on the topics covered in AGSYSMT/HCS 3586.

Interactions with faculty and peers about substantive matters including regular, meaningful faculty mentoring and peer support about conducting interdisciplinary inquiry. Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

This course (3586) was designed by and will be team taught by multi-disciplinary team comprising of faculty from two departments (Food, Agricultural and Biological Engineering [FABE] and Horticulture and Crop Science [HCS]). Faculty in the College of Food, Agricultural, and Environmental Sciences (CFAES) have a philosophy of close interaction, faculty mentoring, and peer support of students that will continue in this interdisciplinary course.

Feedback will be given by the faculty to students in a timely manner on the Homeworks, Discussion, Class interaction and Guest Speaker Reflections. Beyond feedback and office hours, students will have an opportunity to interact with instructors daily (via Carmen or OSU email). After the exams and quizzes, instructors will also provide feedback to the students. Complex sustainability concepts are covered in these courses. So, it will encourage students to interact with each other, with instructors, and guest speakers to get a better understanding of the concepts. Self-Checks will be incorporated in these courses by creating sample question banks for the lecture topics which will allow the students to test their understanding of concepts and topics covered in these courses in a non-graded format. This will encourage students to reflect (check) their understanding of sustainability concepts.

Students will get frequent, timely, and constructive feedback on their work, scaffolding

multiple disciplinary perspectives and integrative synthesis to build over time. Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

We will give six quizzes [one every two weeks] and seven homework assignments [one every two weeks] during the semester. In addition, instructors will provide timely and constructive feedback to students on Technical Feasibility and Sustainability Study [six sections with deadlines], quizzes, homeworks, and the guest speaker reflections during the semester. The quizzes will be graded by Carmen providing immediate feedback to the students. The quiz questions will also be used for the self-checks allowing students to review their knowledge. The homework's will be graded and returned in the following week with instructor's feedback. The technical feasibility and sustainability study will be developed by the students over the entire semester as every component has a deadline for students to meet. Students will also incorporate information and ideas from the guest speaker reflections into the technical feasibility and sustainability study.

Periodic, structured opportunities to reflect and integrate learning (e. g. students should work to integrate their insights and construct a more comprehensive perspective on the issue). Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

Reflections and integrated learning are key components of the Laboratory Activities, Guest Speaker Reflections, and the Technical Feasibility and Sustainability. Questions are designed to elicit students' views, their critique of the presentations, and classroom activities. Students will reflect on and critique the course activities and their impact on them as an individual and impact on their potential career opportunities. In addition, they will reflect their impact on food systems, environment, and society at local, national, and global scales. The activities (Guest Speakers, and Feasibility Study) are planned throughout the semester. The instructors will provide feedback on the activities to the students encouraging them to develop more comprehensive views on digital agriculture and sustainability.

Opportunities to discover relevance of learning through real-world applications and the integration of course content to contemporary global issues and contexts. Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

Real-world learning has been incorporated into Lecture topics, Guest Speaker Reflections, Laboratory Activities, and Technical Feasibility and Sustainability Study. Lecture topics in the course encompasses the following issues: environmental impact of different production practices, food security/safety/traceability, climate change/extreme weather impacts, sustainability, carbon sequestration, viability of rural communities (profit, labor availability, etc.), and water quality and quantity. The Guest Speakers/invited speakers are current experts who will speak about their careers and opportunities in sustainable digital agriculture, future of food systems, and the current sustainability issues. The Laboratory Activities are hands on, but they also allow the students to incorporate the content/knowledge from the Guest Speakers and apply it to that exercise. The Technical Feasibility and Sustainability Study provides an opportunity for the students to integrate course materials, faculty feedback, and expert opinions.

Public Demonstration of competence, such as a significant public communication of their integrative analysis of the issue. Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

Technical Feasibility and Sustainability Study presentation - Each student will create a 90 to 120 seconds video based on their Technical Feasibility and Sustainability Study. The video will be uploaded to a Carmen Discussion area. Other students will review the posted video and make their comments via Discussion. The student who created the video must respond to comments and questions by fellow students, instructors, and interested participants.

Students will also make a live presentation in the class and will be followed up with a Q&A. The instructors and other students will participate in the Q&A. The presenter will be expected to lead the Q&A.

The instructor will provide the students with a detailed presentation guideline. This will help students to plan their presentation.

Experiences with diversity wherein students demonstrate intercultural competence and empathy with people and worldview frameworks that may differ from their own. Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

Data-driven agriculture and food systems have global scope. Agriculture can represent different cultures: such as i) small holder vs corporate, ii) urban rural interface, iii) organic vs conventional, iv) "Plain clothes cultures", and v) USA vs international. Students investigate these viewpoints within the context of data-driven agriculture and food systems. Students consider how new and current practices or technologies impact various populations and cultures. They will be encouraged to consider topics from other cultures/regions for Technical Feasibility and Sustainability Study. Homeworks (1, 3, 4, and 7) have international components embedded - social media or technology developed for and in conjunction with humans and worldviews and conceptual frameworks.

Explicit and intentional efforts to promote inclusivity and a sense of belonging and safety for students, e.g. universal design principles, culturally responsive pedagogy, structured development of cultural self-awareness. Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

The lecture topics in these courses are designed to encompass different student populations. All students, including those familiar with agriculture and food systems, engineering, agronomy, horticulture, and controlled environment agriculture, as well as students with more diverse backgrounds and experience (e.g., sustainability, environment, social issues) will find a place in these courses. Each Homework is designed to expose students to cultures outside their experiences. Some technologies are developed outside of the student's own culture. As part of the homeworks, students are asked to consider how their technology of choice impacts their culture and other cultures via online communication/discussion.

Homework's given in these courses will expose students to other ideas, cultures, methods of communication all within the university environment by following a structured methodology. Feedback from their fellow classmates and instructors will provide students with a safe environment to modify/refine their writing reflecting different views and their awareness of other human beings, cultures, and methodologies.

Clear plans to promote this course to a diverse student body and increase enrollment of typically underserved populations of students. Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

This course is open for enrollment to students from all backgrounds, views, and cultures. These courses are open for enrollment to students from all backgrounds, views, and cultures. Diverse views are encouraged and will be respected. The teaching team includes instructors from Brazil, New Zealand, and USA. The Guest Speakers invited will include industry professionals, experts, and stakeholders from diverse backgrounds who will bring their own work/cultural experiences to the classroom.

AGSYSMT-HCS 3586 Example Of High-Impact Practice – Interdisciplinary Team-Teaching

Example:

Lecture Topic

Variable Rate Technology (VRT) and its Role in Long-Term Soil Health and Sustainability

VRT is based on the soil characteristics, crop/plants nutrient requirement, and impact of management decisions on sustainability, environment, and economic benefits. Horticulture and Crop Science faculty will focus on soil fertility, soil health, and management practices. Faculty from Food, Agricultural and Biological Engineering focus on selection of agricultural equipment (tractors, planters etc.) that will help to maintain soil health and sustainability, using soil sensors to monitor soil health, data collection, and processing to make data driven management decisions. It is this synthesis of different disciplines that allows VRT to have an impact on sustainability.

Readings

Chapters or sections from multiple textbooks will be used for this lecture topic.

[DAS] Marçal de Queiroz, Daniel, et al., editors. *Digital Agriculture*. Springer, 2022.

https://library.ohio-state.edu/record=b10547384~S7

https://doi.org/10.1007/978-3-031-14533-9

https://link.springer.com/content/pdf/10.1007/978-3-031-14533-9.pdf?pdf=button

Chapter 9 Control and Automation Systems in Agricultural Machinery p143 14 pages

Readings Articles

– from both disciplines – note HCS or FABE in front of reading.

Carbon Cycling and Sequestration (These are the sustainability concepts for this lecture)

CCS-7 *HCS* Lal, R. (2019). Accelerated soil erosion as a source of atmospheric CO2. Soil & Tillage Research, 188, 35-40. doi:10.1016/j.still.2018.02.001 6 pages

Climate Smart Agriculture

CSA-4 *FABE* Sarker, M. N. I., Wu, M., Alam, G. M. M., & Islam, M. S. (2019). Role of climate smart agriculture in promoting sustainable agriculture: a systematic literature review. International Journal of Agricultural Resources, Governance and Ecology, 15(4), 323-337. doi:10.1504/ijarge.2019.104199 14 pages

Food Production Optimization and Efficiency

FPO-5 *HCS* Rosa-Schleich, J., Loos, J., Musshoff, O., & Tscharntke, T. (2019). Ecological-economic trade-offs of Diversified Farming Systems - a review. Ecological Economics, 160, 251-263. doi:10.1016/j.ecolecon.2019.03.002 12 pages

Nitrogen and Phosphorus Cycling and Use Efficiency

NPC-4 *FABE HCS* Colaco, A. F., & Bramley, R. G. V. (2018). Do crop sensors promote improved nitrogen management in grain crops? Field Crops Research, 218, 126-140. doi:10.1016/j.fcr.2018.01.007 14 pages

Water Quality and Quantity

WQQ-11 *HCS* Ward, M. H., Jones, R. R., Brender, J. D., Kok, T. M. d., Weyer, P. J., Nolan, B. T., . . . Breda, S. G. v. (2018). Drinking water nitrate and human health: an updated review. International Journal of Environmental Research and Public Health, 15(7), 1557. doi:10.3390/ijerph15071557 31 pages

Video

Each video emphasizes one or more of the disciplines key concepts and in some cases will display concepts for both disciplines.

Professionally produced video will not feature either of the faculty teaching this lecture. If the faculty create their own videos, a) they may be single use by one of them, b) may be created by both individuals concerning a specific concept, or c) created by both individuals to incorporate and synthesize information for the student.

Discussion Questions

How does Variable Rate Application reduce inputs, maximize crop yield, and promotes sustainability? (Some possible areas of discussion)

Each instructor would listen/review the student's response to gauge their understanding of the lecture content and the reading materials. Students will receive comments from both FABE and HCS faculty allowing students to gain a more complete understanding of VRT and their impact on the environment, profitability, and sustainability.

HCS – Soil Organic Matter, texture, soil erosion, NPK and other nutrient management, crop variety selection, planting, management, and their impact on crop yield

FABE – Prescription map generation, using sensors to monitor soil health, tillage methods, cost of inputs, economic benefits of VRT adoption, environmental benefits, and impact of VRT on sustainability, environment, and profitability.

Quizzes/Exams

– tests understanding of concepts taught in the lecture but not focused on data analysis

HCS – Soil Organic Matter, texture, soil erosion, NPK and other nutrient management, crop variety selection, planting, management, and their impact on crop yield

FABE – Prescription map generation, using sensors to monitor soil health, tillage methods, cost of inputs, economic benefits of VRT adoption, environmental benefits, and impact of VRT on sustainability.

Combined– management practices for higher crop yield with minimal impact on sustainability.

Homeworks

None for this lecture – Following is an example only.

Data (soil fertility, fertilizer types, fertilizer application method, plant variety, plant population etc.) is given to the students. Students must apply the concepts, discuss which methods/practices, discuss the possible outcomes and impact on yield, profitability, and sustainability. Faculty are judging the student's choices and the results of those choices. 2-page limit.

Readings for AGSYSMT-HCS 3586

All textbooks and articles listed here are available free as eBooks or online journals with OSU Libraries.

- The other books and articles provide supplemental or primary readings on certain topics. **[XYZ] are bolded letters in the items below.**
- **[DAS]** Marçal de Queiroz, Daniel, et al., editors. ***D**igital **A**griculture*. **S**pringer, 2022. https://library.ohio-state.edu/record=b10547384~S7
- **[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). **P**recision **a**griculture **b**asics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375
- **[WPA]** Hamrita, T. K. (Ed.). (2021). **W**omen in **p**recision **a**griculture: technological breakthroughs, challenges and aspirations for a prosperous and sustainable future (Ser. Women in engineering and science). Springer. https://osu.on.worldcat.org/oclc/1187169922 https://ebooks.ohiolink.edu/viewer/e7ec4ef2-6500-11eb-af00-0a9b31268bf5/1

Recommended/Optional Materials

- **[TRB]** Crawley, M. J. (2013). **T**he **R b**ook (Second). Wiley. Retrieved July 21, 2022, https://osu.on.worldcat.org/oclc/809365744 Not referenced.
- **[OAG]** ***O**hio **A**gronomy **G**uide 15th Edition, Bulletin 472* | *Agronomic Crops Network*. https://agcrops.osu.edu/publications/ohio-agronomy-guide-15th-edition-bulletin-472. Accessed 21 Dec. 2022.
- **[EBS]** ***EB**arn**s** – Putting Data in Producers' Hands | Ohio BEEF Cattle Letter*. https://u.osu.edu/beef/2022/08/24/ebarns-putting-data-in-producers-hands/. Accessed 21 Dec. 2022.
- **[EFS]** ***EF**ield**s** On-Farm Research* | *Digital Ag*. https://digitalag.osu.edu/efields. Accessed 21 Dec. 2022.

Sustainability Concepts -selected journal articles.

*[A-CCS] **C**arbon **c**ycling and **s**equestration selected journal articles:*

A-CCS-2 Bossio, D. A., Cook-Patton, S. C., Ellis, P. W., Fargione, J., Sanderman, J., Smith, P., . . . Griscom, B. W. (2020). The role of soil carbon in natural climate solutions. Nature Sustainability, 3(5), 391-398. doi:10.1038/s41893-020-0491-z p391 8 pages.

A-CCS-3 Chenu, C., Angers, D. A., Barre, P., Derrien, D., Arrouays, D., & Balesdent, J. (2019). Increasing organic stocks in agricultural soils: knowledge gaps and potential innovations. Soil & Tillage Research, 188, 41-52. doi:10.1016/j.still.2018.04.011 p41 11 pages.

A-CCS-6 Kopittke, P. M., Menzies, N. W., Wang, P., McKenna, B. A., & Lombi, E. (2019). Soil and the intensification of agriculture for global food security. Environment International, 132, 105078. doi:10.1016/j.envint.2019.105078 p1 7 pages.

A-CCS-10 Wiesmeier, M., Urbanski, L., Hobley, E., Lang, B., Lutzow, M. v., Marin-Spiotta, E., . . . Kogel-Knabner, I. (2019). Soil organic carbon storage as a key function of soils - a review of drivers and indicators at various scales. Geoderma, 333, 149-162. doi:10.1016/j.geoderma.2018.07.026 p149 13 pages.

[A-WQQ] *W**ater** **q**uality and **q**uantity -selected journal **a**rticles:*

A-WQQ-1 Bierkens, M. F. P., & Wada, Y. (2019). Non-renewable groundwater use and groundwater depletion: a review. Environmental Research Letters, 14(6). doi:10.1088/1748-9326/ab1a5f p1 43 pages.

Duncan, E. W., Osmond, D. L., Shober, A. L., Starr, L., Tomlinson, P., Kovar, J. L., . . . Reid, K. (2019). Phosphorus and soil health management practices. Agricultural and Environmental Letters, 4(1), 190014. doi:10.2134/ael2019.04.0014 p1 5pages.

Emde, D., Hannam, K. D., Most, I., Nelson, L. M., & Jones, M. D. (2021). Soil organic carbon in irrigated agricultural systems: a meta-analysis. Global Change Biology, 27(16), 3898-3910. doi:10.1111/gcb.15680 p3898 12pages.

A-WQQ-4 Liu, J., & Lobb, D. A. (2021). An overview of crop and crop residue management impacts on crop water use and runoff in the Canadian prairies. Water, 13(20). doi:10.3390/w13202929 p1 16 pages.

A-WQQ-7 Skaalsveen, K., Ingram, J., & Clarke, L. E. (2019). The effect of no-till farming on the soil functions of water purification and retention in north-western Europe: a literature review. Soil & Tillage Research, 189, 98-109. doi:10.1016/j.still.2019.01.004 p98 18 pages.

A-WQQ-9 Souza, R. M. d., Seibert, D., Quesada, H. B., Bassetti, F. d. J., Fagundes-Klen, M. R., & Bergamasco, R. (2020). Occurrence impacts and general aspects of pesticides in surface water: a review. Process Safety and Environmental Protection, 135, 22-37. doi:10.1016/j.psep.2019.12.035 p22 15 pages.

[A-FPO] Food production optimization and efficiency -*selected journal articles:*

A-FPO-4 Ricciardi, V., Mehrabi, Z., Wittman, H., James, D., & Ramankutty, N. (2021). Higher yields and more biodiversity on smaller farms. Nature Sustainability, 4(7), 651-657. doi:10.1038/s41893-021-00699-2 p651 6 pages.

A-FPO-5 Rosa-Schleich, J., Loos, J., Musshoff, O., & Tscharntke, T. (2019). Ecological-economic trade-offs of Diversified Farming Systems - a review. Ecological Economics, 160, 251-263. doi:10.1016/j.ecolecon.2019.03.002 p160 12 pages.

[A-NPC] Nitrogen and phosphorus cycling and use efficiency -*selected journal articles*:

A-NPC-1 Abbott, L. K., Macdonald, L. M., Wong, M. T. F., Webb, M. J., Jenkins, S. N., & Farrell, M. (2018). Potential roles of biological amendments for profitable grain production - a review. Agriculture, Ecosystems & Environment, 256, 34-50. doi:10.1016/j.agee.2017.12.021 p34 6 pages.

A-NPC-2 Barkha, & Ananya, C. (2021). Effect of integrated nutrient management on nutrient use efficiency of major nutrients: a review. Plant Archives, 21(1), 1084-1089. doi:10.51470/PLANTARCHIVES.2021.v21.no1.143 p1084 5pages.

A-NPC-3 Carr, P. M., Cavigelli, M. A., Darby, H., Delate, K., Eberly, J. O., Gramig, G. G., . . . Woodley, A. L. (2019). Nutrient cycling in organic field crops in Canada and the United States. Agronomy Journal, 111(6), 2769-2785. doi:10.2134/agronj2019.04.0275 p2769 16 pages.

A-NPC-4 Colaco, A. F., & Bramley, R. G. V. (2018). Do crop sensors promote improved nitrogen management in grain crops? Field Crops Research, 218, 126-140. doi:10.1016/j.fcr.2018.01.007 p126 14 pages.

A-NPC-5 Duncan, E. G., O'Sullivan, C. A., Roper, M. M., Biggs, J. S., & Peoples, M. B. (2018). Influence of co-application of nitrogen with phosphorus, potassium and Sulphur on the apparent efficiency of nitrogen fertilizer

use, grain yield and protein content of wheat: review. Field Crops Research, 226, 56-65. doi:10.1016/j.fcr.2018.07.010 p56 9 pages.

A-NPC-6 Folina, A., Tataridas, A., Mavroeidis, A., Kousta, A., Katsenios, N., Efthimiadou, A., . . . Kakabouki, I. (2021). Evaluation of various nitrogen indices in N-fertilizers with inhibitors in field crops: a review. Agronomy, 11(3). doi:10.3390/agronomy11030418 1p 25 pages.

A-NPC-7 Liu, C., Plaza-Bonilla, D., Coulter, J. A., Kutcher, H. R., Beckie, H. J., Wang, L., . . . Gan, Y. (2022). Diversifying crop rotations enhances agroecosystem services and resilience. Advances in Agronomy, 173, 299-335. doi:10.1016/bs.agron.2022.02.007 p299 36 pages.

A-NPC-8 Losacco, D., Ancona, V., Paola, D. d., Tumolo, M., Massarelli, C., Gatto, A., & Uricchio, V. F. (2021). Development of ecological strategies for the recovery of the main nitrogen agricultural pollutants: a review on environmental sustainability in agroecosystems. Sustainability, 13(13). doi:10.3390/su13137163 p1 17 pages.

A-NPC-9 Martinez-Dalmau, J., Berbel, J., & Ordonez-Fernandez, R. (2021). Nitrogen fertilization. A review of the risks associated with the inefficiency of its use and policy responses. Sustainability, 13(10). doi:10.3390/su13105625 p1 17 pages.

A-NPC-10 Swaney, D. P., & Howarth, R. W. (2019). Phosphorus use efficiency and crop production: patterns of regional variation in the United States, 1987-2012. Science of the Total Environment, 685, 174-188. doi:10.1016/j.scitotenv.2019.05.228 p175 14 pages.

A-NPC-13 Wang, Z., & Li, S. (2019). Nitrate N loss by leaching and surface runoff in agricultural land: a global issue (a review). Advances in Agronomy, 156, 159-217. doi: 10.1016/bs.agron.2019.01.007 p159 40 pages.

[A-CSA] *Climate-Smart Agriculture -selected journal articles:*

A-CSA-1 Barasa, P. M., Botai, C. M., Botai, J. O., & Mabhaudhi, T. (2021). A review of climate-smart agriculture research and applications in Africa. Agronomy, 11(6). doi:10.3390/agronomy11061255 p1 26 pages.

A-CSA-2 Gardezi, M., Michael, S., Stock, R., Vij, S., Ogunyiola, A., & Ishtiaque, A. (2022). Prioritizing climate-smart agriculture: an organizational and temporal review. Wiley Interdisciplinary Reviews: Climate Change, 13(2). doi:10.1002/wcc.755 p1 15 pages.

A-CSA-3 Mizik, T. (2021). Climate-smart agriculture on small-scale farms: a systematic literature review. Agronomy, 11(6). doi:10.3390/agronomy11061096/ p1 16 pages.

A-CSA-4 Sarker, M. N. I., Wu, M., Alam, G. M. M., & Islam, M. S. (2019). Role of climate smart agriculture in promoting sustainable agriculture: a systematic literature review. International Journal of Agricultural Resources, Governance and Ecology, 15(4), 323-337. doi:10.1504/ijarge.2019.104199 p323 4 pages.

A-CSA-5 Thornton, P. K., Whitbread, A., Baedeker, T., Cairns, J., Claessens, L., Baethgen, W., . . . Keating, B. (2018). A framework for priority-setting in climate smart agriculture research. Agricultural Systems, 167, 161-175. doi:10.1016/j.agsy.2018.09.009 p161 12 pages.

A-CSA-6 Totin, E., Segnon, A. C., Schut, M., Affognon, H., Zougmore, R. B., Rosenstock, T., & Thornton, P. K. (2018). Institutional perspectives of climate-smart agriculture: a systematic literature review. Sustainability, 10(6), 1990. doi:10.3390/su10061990 p1 20 pages.

A-CSA-7 Zougmore, R. B., Laderach, P., & Campbell, B. M. (2021). Transforming food systems in Africa under climate change pressure: role of climate-smart agriculture. Sustainability, 13(8). doi:10.3390/su13084305 p1 17 pages.

[A-FSY] Food safety *-selected journal articles:*

A-FSY-1 Adeyeye, S. A. O. (2020). Aflatoxigenic fungi and mycotoxins in food: a review. Critical Reviews in Food Science and Nutrition, 60(5), 709-721. doi:10.1080/10408398.2018.1548429 p709 13 pages.

A-FSY-2 Anil, P., Navnidhi, C., Neelesh, S., & Sundeep, J. (2018). Role of Food Safety Management Systems in safe food production: a review. Journal of Food Safety, 38(4), e12464. doi:10.1111/jfs.12464 p1-1 11 pages.

A-FSY-3 Chen, H., Kinchla, A. J., Richard, N., Shaw, A., & Feng, Y. (2021). Produce growers' on-farm food safety education: a review. Journal of Food Protection, 84(4), 704-716. doi:10.4315/jfp-20-320 p704 13 pages.

A-FSY-4 Duchenne-Moutien, R. A., & Neetoo, H. (2021). Climate change and emerging food safety issues: a review. Journal of Food Protection, 84(11), 1884-1897. doi:10.4315/jfp-21-141 p1884 14 pages.

A-FSY-5 Lenzi, A., Marvasi, M., & Baldi, A. (2021). Agronomic practices to limit pre- and post-harvest contamination and proliferation of human pathogenic Enterobacteriaceae in vegetable produce. Food Control, 119. doi:10.1016/j.foodcont.2020.107486 p1 11 pages.

A-FSY-6 Riggio, G. M., Wang, Q., Kniel, K. E., & Gibson, K. E. (2019). Microgreens - a review of food safety considerations along the farm to fork continuum. International Journal of Food Microbiology, 290, 76-85. doi:10.1016/j.ijfoodmicro.2018.09.027 p76 10 pages.

[A-FOS] *Food security -selected journal articles:*

A-FOS-1 Ali, R., Ali, R., Mehmood, S. S., Zou, X., Zhang, X., Lv, Y., & Xu, J. (2019). Impact of climate change on crops adaptation and strategies to tackle its outcome: a review. Plants, 8(2), 34. doi:10.3390/plants8020034 p1 29 pages.

A-FOS-2 Karthikeyan, L., Chawla, I., & Mishra, A. K. (2020). A review of remote sensing applications in agriculture for food security: crop growth and yield, irrigation, and crop losses. Journal of Hydrology (Amsterdam), 586. doi:10.1016/j.jhydrol.2020.124905 p1 22 pages.

A-FOS-3 Leisner, C. P. (2020). Review: climate change impacts on food security- focus on perennial cropping systems and nutritional value. Plant Science, 293. doi:10.1016/j.plantsci.2020.110412 p1 7 pages.

A-FOS-4 Ramankutty, N., Mehrabi, Z., Waha, K., Jarvis, L., Kremen, C., Herrero, M., & Rieseberg, L. H. (2018). Trends in global agricultural land use: Implications for environmental health and food security. Annual Review of Plant Biology, 69, 789-815. doi:10.1146/annurev-arplant-042817-040256 p1 30 pages.

A-FOS-5 Wezel, A., Herren, B. G., Kerr, R. B., Barrios, E., Goncalves, A. L. R., & Sinclair, F. (2020). Agroecological principles and elements and their implications for transitioning to sustainable food systems. a review. Agronomy for Sustainable Development, 40(6). doi:10.1007/s13593-020-00646-z p1 13 pages.

Readings by lecture

	Week	Topics	Readings
1	**1**	Introduction to Digital Agriculture and its Role in Sustainability	**[DAS]** Marçal de Queiroz, Daniel, et al., editors. *Digital Agriculture*. Springer, 2022. https://library.ohio-state.edu/record=b10547384~S7 **Chapter 1 – The Agriculture Eras p1 12 pages.** **[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). Precision agriculture basics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375 **Chapter 1 - An Introduction to Precision Agriculture p1 12 pages.** **[WPA]** Hamrita, T. K. (Ed.). (2021). Women in precision agriculture: technological breakthroughs, challenges and aspirations for a prosperous and sustainable future (Ser. Women in engineering and science). Springer. https://osu.on.worldcat.org/oclc/1187169922 **Chapter 1.2.3 New Sensing Technologies Are the Backbone of Precision Agriculture 7p 5 pages.**
2	**1**	Global Navigation Satellite Systems (GNSS) in Agriculture and Natural Resource Conservation	**[DAS]** Marçal de Queiroz, Daniel, et al., editors. *Digital Agriculture*. Springer, 2022. https://library.ohio-state.edu/record=b10547384~S7 **Chapter 2 – Global Navigation Satellite Systems p13 14 pages.** **[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). Precision agriculture basics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375 **Chapter 3 - Satellite-based Positioning Systems for Precision Agriculture p25 12 pages.**
3	**2**	ArcGIS and Applications in Agricultural Sustainability	**[DAS]** Marçal de Queiroz, Daniel, et al., editors. *Digital Agriculture*. Springer, 2022. https://library.ohio-state.edu/record=b10547384~S7 **Chapter 2 – Spatial and Temporal Variability Analysis p27 17 pages** **[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). Precision agriculture basics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375 **Chapter 4 - Basics of Geographic Information System p37 16 pages.**
4	**2**	Farm Management Information Systems (FMIS) for Sustainable Management	**[DAS]** Marçal de Queiroz, Daniel, et al., editors. *Digital Agriculture*. Springer, 2022. https://library.ohio-state.edu/record=b10547384~S7 **Chapter 15 – Platforms, Applications, and Software p259 13 pages.** **[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). Precision agriculture basics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375 **Chapter 2 – Understanding and Identify Variability p13 12 pages.** **Chapter 4 - Basics of Geographic Information System p37 16 pages.** **Chapter 7 - Pest Measurement and Management p93 10 pages.** **Chapter 11 - Precision Variable Equipment p155 14 pages.** **[WPA]** Hamrita, T. K. (Ed.). (2021). Women in precision agriculture: technological breakthroughs, challenges and aspirations for a prosperous and sustainable future (Ser. Women in engineering and science). Springer. https://osu.on.worldcat.org/oclc/1187169922 https://ebooks.ohiolink.edu/viewer/e7ec4ef2-6500-11eb-af00-0a9b31268bf5/1 **Chapter 1.2.5 Robots and Variable Rate Technology p13 1 page.**

			Chapter 1.4.1 Implementation of Precision Agriculture and Related Challenges p20 1 page. **Chapter 2.2 Crop Sensing Technology p37 23pages.** **Chapter 2.3 Soil Sensing Technology p39 2 pages.** **Chapter 2.4 Root Sensing Technology p41 3 pages.** **Chapter 2.6 Examples of Sensing Technologies for Precision Agriculture Applications p44 6 pages.** **Chapter 5.6 Optimization of resources p93 3 pages.** A-CCS-2 p391 8 pages. A-CCS-10 p149 13 pages A-FPO-4 p651 6 pages. A-FPO-5 p160 12 pages.
5	**3**	Variable Rate Technology and its Role in Long-Term Soil Health and Sustainability	**[DAS]** Marçal de Queiroz, Daniel, et al., editors. *Digital Agriculture*. Springer, 2022. https://library.ohio-state.edu/record=b10547384~S7 **Chapter 9 – Control and Automation Systems in Agricultural Machinery p143 14 pages.** **[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). Precision agriculture basics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375 **Chapter 2 – Understanding and Identify Variability p13 12 pages.** **Chapter 7 - Pest Measurement and Management p93 10 pages.** **Chapter 11 - Precision Variable Equipment p155 14 pages.** **[WPA]** Hamrita, T. K. (Ed.). (2021). Women in precision agriculture: technological breakthroughs, challenges and aspirations for a prosperous and sustainable future (Ser. Women in engineering and science). Springer. https://osu.on.worldcat.org/oclc/1187169922 https://ebooks.ohiolink.edu/viewer/e7ec4ef2-6500-11eb-af00-0a9b31268bf5/1 **Chapter 1.2.5 Robots and Variable Rate Technology p13 1 page.** **Chapter 1.4.1 Implementation of Precision Agriculture and Related Challenges p20 1 page.** **Chapter 2.2 Crop Sensing Technology p37 1 page.** **Chapter 2.3 Soil Sensing Technology p39 3 pages.** **Chapter 2.4 Root Sensing Technology p41 3 pages.** **Chapter 2.6 Examples of Sensing Technologies for Precision Agriculture Applications p44 6 pages.** A-CCS-3 p41 11 pages. A-CCS-6 p1 7 pages. A-WQQ-4 p1 16 pages. A-WQQ-7 p98 18 pages. A-WQQ-9 p22 15 pages. A-FPO-4 p651 6 pages. A-FPO-5 p160 12 pages.
6	**3**	Soil Health Soil Sampling and Soil Sensing	**[DAS]** Marçal de Queiroz, Daniel, et al., editors. *Digital Agriculture*. Springer, 2022. https://library.ohio-state.edu/record=b10547384~S7 **Chapter 6 – Sampling and Interpretation of Maps p143 14 pages.** **[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). Precision agriculture basics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375

			Chapter 6 - Soil Variability and Fertility Management p81 19 pages. **[WPA]** Hamrita, T. K. (Ed.). (2021). Women in precision agriculture: technological breakthroughs, challenges and aspirations for a prosperous and sustainable future (Ser. Women in engineering and science). Springer. https://osu.on.worldcat.org/oclc/1187169922 https://ebooks.ohiolink.edu/viewer/e7ec4ef2-6500-11eb-af00-0a9b31268bf5/1 **Chapter 3.2 Why Does Soil Fertility Matter? p57 1 page.** **Chapter 3.3.1 Principles Guiding Fertilizer Use in Nutrient-Deficient Soils p60 1 page.** **Chapter 3.4.1 Observations About Nutrient-Excessive Soils p61 3 pages.** **Chapter 3.5 Precision Agriculture, a Smart System for Soil Nutrient Management p54 8 pages.** **Chapter 4.4 Ecological Aspects (Nitrogen Use Efficiency, Nmin) p76 1 page.** **Chapter 5.7 Unforeseen Consequences (Weed Increases, Labor Decreases, Workforce Education) p96 4 pages.** **[EFS]** *EFields On-Farm Research* | *Digital Ag*. https://digitalag.osu.edu/efields. Accessed 21 Dec. 2022. **Chapter Soil Health Survey Across Ohio Farms p274 2 pages.** A-CCS-6 p1 7 pages. A-CCS-10 p149 13 pages. A-WQQ-4 p1 16 pages. A-WQQ-9 p22 15 pages.
7	**4**	Yield Monitoring Technologies for Optimal Resource Management	**[DAS]** Marçal de Queiroz, Daniel, et al., editors. *Digital Agriculture*. Springer, 2022. https://library.ohio-state.edu/record=b10547384~S7 **Chapter 8 – Sensors and Actuators p123 19 pages.** **[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). Precision agriculture basics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375 **Chap 5 – Yield Monitoring and Mapping p63 13 pages.**
8	**4**	Historical Yield Data and its Implications for Sustainability	**[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). Precision agriculture basics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375 **Chapter 12 - Precision Agriculture Data Management p169 20 pages.**
9	**5**	Artificial Intelligence Primer	
10	**5**	Artificial Intelligence and Crop Care	
11	**6**	Controller Area Networks (CAN) and Connected Machines	**[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). Precision agriculture basics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375 **Chapter 10 - Electronics and Control Systems p169 20 pages.**
12	**6**	The Ethics of Data Ownership, Aggregation, and Cloud Computing	**[WPA]** Hamrita, T. K. (Ed.). (2021). Women in precision agriculture: technological breakthroughs, challenges and aspirations for a prosperous and sustainable future (Ser. Women in engineering and science). Springer. https://osu.on.worldcat.org/oclc/1187169922

			https://ebooks.ohiolink.edu/viewer/e7ec4ef2-6500-11eb-af00-0a9b31268bf5/1 **Chapter 1.2.4 Data Mining and Precision Agriculture p12 1 page.**
13	**7**	Google Earth Applications in Production and Urban Agriculture	
14	**7**	Remote Sensing and Applications in Sustainable Agriculture	**[DAS]** Marçal de Queiroz, Daniel, et al., editors. *Digital Agriculture*. Springer, 2022. https://library.ohio-state.edu/record=b10547384~S7 **Chapter 4 - Images and Remote Sensing Applied to Agricultural Management p45 13 pages.** **[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). Precision agriculture basics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375 **Chapter 8 - Remote Sensing for Site-Specific Plant Management p169 20 pages.** **Chapter 9 - Proximal Soil and Crop Sensing p119 22 pages.**
15	**8**	Drone Applications in Sustainable Agriculture	**[DAS]** Marçal de Queiroz, Daniel, et al., editors. *Digital Agriculture*. Springer, 2022. https://library.ohio-state.edu/record=b10547384~S7 **Chapter 7 - Application of Drones in Agriculture p99 23 pages.** **[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). Precision agriculture basics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375 **Chapter 9 - Proximal Soil and Crop Sensing p119 22 pages.**
16	**8**	Precision Conservation Management	A-CCS-2 p391 8 pages. A-WQQ-4 p1 16 pages.
17	**9**	Controlled Environment Agriculture	A-CCS-2 p391 8 pages.
18	**9**	Tracking Weather and Climate Change	
	10	Spring Break	
	10	Spring Break	
19	**11**	Precision Livestock Farming Systems	**[DAS]** Marçal de Queiroz, Daniel, et al., editors. *Digital Agriculture*. Springer, 2022. https://library.ohio-state.edu/record=b10547384~S7 **Chapter 11 - Application of Drones in Agriculture p173 20 pages.** **[WPA]** Hamrita, T. K. (Ed.). (2021). Women in precision agriculture: technological breakthroughs, challenges and aspirations for a prosperous and sustainable future (Ser. Women in engineering and science). Springer. https://osu.on.worldcat.org/oclc/1187169922 https://ebooks.ohiolink.edu/viewer/e7ec4ef2-6500-11eb-af00-0a9b31268bf5/1 **Chapter 1.2.7 Breeding and Precision Agriculture p15 1 page.** **Chapter 1.3 Precision Agriculture in Animal Production: Enabling Technologies and Applications p15 1 page.** **Chapter 1.3.1 Cattle and Sheep PLF Applications p17 2 pages.** **Chapter 1.3.2 Swine p18 1 page.**

			Chapter 1.3.3 Poultry p19 1 page. **Chapter 9.2 Automated Monitoring of Feeding and Drinking Patterns in Growing-Finishing Pigs p183 4 pages.** **Chapter 9.3 Toward a Warning System for Performance, Health, and Welfare Problems in Individual Pigs p187 3 pages**
20	**11**	Managing Pasture Based Livestock Systems	A-FPO-4 p651 6 pages. A-FPO-5 p160 12 pages.
21	**12**	Crop and Animal Modeling	A-FPO-4
22	**12**	Precision Irrigation and Controlled Drainage for Enhance Water Quality	**[DAS]** Marçal de Queiroz, Daniel, et al., editors. *Digital Agriculture*. Springer, 2022. https://library.ohio-state.edu/record=b10547384~S7 **Chapter 10 - Digital Irrigation p157 25 pages.** **[WPA]** Hamrita, T. K. (Ed.). (2021). Women in precision agriculture: technological breakthroughs, challenges and aspirations for a prosperous and sustainable future (Ser. Women in engineering and science). Springer. https://osu.on.worldcat.org/oclc/1187169922 https://ebooks.ohiolink.edu/viewer/e7ec4ef2-6500-11eb-af00-0a9b31268bf5/1 **Chapter 6.1 Introduction 1086.2 Precision Irrigation p110 2 pages.** **Chapter 6.2.1 Environmental Factors in the Field Crops p111 1 page.** **Chapter 6.2.2 Wireless Communication Technologies p113 1 page.** A-FPO-5 p160 12 pages. A-WQQ-1 p1 43 pages.
23	**13**	Internet of Things (IoT) and Sustainability	**[DAS]** Marçal de Queiroz, Daniel, et al., editors. *Digital Agriculture*. Springer, 2022. https://library.ohio-state.edu/record=b10547384~S7 **Chapter 12 Internet of Things in Agriculture p 195 26 pages.**
24	**13**	On-Farm Research and its role in Digital Agriculture.	**[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). Precision agriculture basics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375 **Chapter 13 - On-Farm Replicated Strip Trials p189 20 pages.** A-CCS-6 p1 7 pages. A-FPO-4 p651 6 pages. A-FPO-5 p160 12 pages.
25	**14**	Data Analytics and Visualization for Digital Agriculture	**[DAS]** Marçal de Queiroz, Daniel, et al., editors. *Digital Agriculture*. Springer, 2022. https://library.ohio-state.edu/record=b10547384~S7 **Chapter 1 - Data Transmission, Cloud Computing, and Big Data p 195 26 pages.** **[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). Precision agriculture basics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375 **Chapter 13 - Precision Agriculture Data Management p169 20 pages.** **[WPA]** Hamrita, T. K. (Ed.). (2021). Women in precision agriculture: technological breakthroughs, challenges and aspirations for a prosperous and sustainable future (Ser. Women in engineering and science). Springer. https://osu.on.worldcat.org/oclc/1187169922 https://ebooks.ohiolink.edu/viewer/e7ec4ef2-6500-11eb-af00-0a9b31268bf5/1

			Chapter 1.2.4 Data Mining and Precision Agriculture p12 1 page.
26	**14**	AI in Marketing and Agricultural Supply Chain Logistics	
27	**15**	Application of Blockchain Technology in Agricultural Supply Chain	
28	**15**	Enterprise Agriculture and Sustainability	**[PAB]** Shannon, D. K., Clay, D., and Kitchen, N. R. (Eds.). (2018). Precision agriculture basics. American Society of Agronomy. https://osu.on.worldcat.org/oclc/1037150375 **Chapter 14 - Environmental Implications of Precision Agriculture p209 12 pages.** **Chapter 15 - Economics of Precision Farming p221 12 pages.** A-WQQ-4 p1 16 pages.
		Finals	

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Teaching Schedule and Interdisciplinary Learning Outcomes

Lec#	Week	Class (3586)	Interdisciplinary Learning Outcome	FABE Lead	HCS Lead
1	**1**	Introduction to Digital Agriculture and its Role in Sustainability	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture IITT 1.1.b - Analysis: Interpret and evaluate information from multiple sources and multiple disciplinary perspectives to develop a comprehensive analysis or synthesis, and thoroughly question the viewpoints of experts and professionals. Lecture IITT 1.1.c - Critical thinking & analysis Systematically and methodically analyze their own and others' assumptions using more than one disciplinary lens and carefully evaluate the relevance of contexts when representing a position. Lecture IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture IITT ELO 2.2.b. Empathy: Interpret and explain the issue under consideration from the perspectives other than their own and more than one worldview and demonstrates openness towards others in the academic community and their perspectives. Lecture	X	X
2	**1**	Global Navigation Satellite Systems (GNSS) in Agriculture and Natural Resource Conservation	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture	X	

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Teaching Schedule and Interdisciplinary Learning Outcomes

Lec#	Week	Class (3586)	Interdisciplinary Learning Outcome	FABE Lead	HCS Lead
3	**2**	ArcGIS and Applications in Agricultural Sustainability	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture IITT 1.1.b - Analysis: Interpret and evaluate information from multiple sources and multiple disciplinary perspectives to develop a comprehensive analysis or synthesis, and thoroughly question the viewpoints of experts and professionals. Lecture IITT 1.1.c - Critical thinking & analysis Systematically and methodically analyze their own and others' assumptions using more than one disciplinary lens and carefully evaluate the relevance of contexts when representing a position. Lecture IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture IITT 2.1.a Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture IITT ELO 2.2.b. Empathy: Interpret and explain the issue under consideration from the perspectives other than their own and more than one worldview and demonstrates openness towards others in the academic community and their perspectives. Lecture	X	X
4	**2**	Farm Management Information Systems (FMIS) for Sustainable Management	IITT ELO 1.1.b Analysis: Interpret and evaluate information from multiple sources and multiple disciplinary perspectives to develop a comprehensive analysis or synthesis, and thoroughly question the viewpoints of experts and professionals. Lecture IITT ELO 1.1.c Critical thinking & analysis Systematically and methodically analyze their own and others' assumptions using more than one disciplinary lens and carefully evaluate the relevance of contexts when representing a position.	X	X

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Teaching Schedule and Interdisciplinary Learning Outcomes

Lec#	Week	Class (3586)	Interdisciplinary Learning Outcome	FABE Lead	HCS Lead
			IITT ELO 1.2.a Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture		
5	**3**	Variable Rate Technology and its Role in Long-Term Soil Health and Sustainability	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture IITT 1.1.b - Analysis: Interpret and evaluate information from multiple sources and multiple disciplinary perspectives to develop a comprehensive analysis or synthesis, and thoroughly question the viewpoints of experts and professionals. Lecture IITT 1.1.c - Critical thinking & analysis Systematically and methodically analyze their own and others' assumptions using more than one disciplinary lens and carefully evaluate the relevance of contexts when representing a position. Lecture IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture IITT 2.1.a - Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture IITT ELO 2.2.b. Empathy: Interpret and explain the issue under consideration from the perspectives other than their own and more than one worldview and demonstrates openness towards others in the academic community and their perspectives. Lecture	X	X
6	**3**	Soil Health Soil Sampling and Soil Sensing	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture		X

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Teaching Schedule and Interdisciplinary Learning Outcomes

Lec#	Week	Class (3586)	Interdisciplinary Learning Outcome	FABE Lead	HCS Lead
			IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture IITT ELO 2.2.b. Empathy: Interpret and explain the issue under consideration from the perspectives other than their own and more than one worldview and demonstrates openness towards others in the academic community and their perspectives. Lecture IITT 2.1.a - Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective Lecture		
7	**4**	Yield Monitoring Technologies for Optimal Resource Management	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture IITT 2.1.a Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture IITT ELO 2.2.b. Empathy: Interpret and explain the issue under consideration from the perspectives other than their own and more than one worldview and demonstrates openness towards others in the academic community and their perspectives. Lecture	X	X
8	**4**	Historical Yield Data and its Implications for Sustainability	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture	X	

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Teaching Schedule and Interdisciplinary Learning Outcomes

Lec#	Week	Class (3586)	Interdisciplinary Learning Outcome	FABE Lead	HCS Lead
			IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture IITT 2.1.a Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture		
9	**5**	Artificial Intelligence Primer	IITT 2.1.a - Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture	X	
10	**5**	Artificial Intelligence and Crop Care	IITT 2.1.a - Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture	X	X
11	**6**	Controller Area Networks (CAN) and Connected Machines	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture IITT ELO 1.2.a Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. IITT 2.1.a Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture	X	
12	**6**	The Ethics of Data Ownership, Aggregation, and Cloud Computing	IITT 1.1.b - Analysis: Interpret and evaluate information from multiple sources and multiple disciplinary perspectives to develop a comprehensive analysis or synthesis, and thoroughly question the viewpoints of experts and professionals. Lecture IITT 1.1.c - Critical thinking & analysis Systematically and methodically analyze their own and others' assumptions using more than one disciplinary lens and carefully evaluate the relevance of contexts when representing a position. Lecture	X	X

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Teaching Schedule and Interdisciplinary Learning Outcomes

Lec#	Week	Class (3586)	Interdisciplinary Learning Outcome	FABE Lead	HCS Lead
			IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture IITT 2.1.a Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture IITT ELO 2.2.b. Empathy: Interpret and explain the issue under consideration from the perspectives other than their own and more than one worldview and demonstrates openness towards others in the academic community and their perspectives.		
13	**7**	Google Earth Applications in Production and Urban Agriculture	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture	X	
14	**7**	Remote Sensing and Applications in Sustainable Agriculture	IITT ELO 1.2.a Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture IITT 2.1.a - Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture	X	
15	**8**	Drone Applications in Sustainable Agriculture	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture	X	X

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Teaching Schedule and Interdisciplinary Learning Outcomes

Lec#	Week	Class (3586)	Interdisciplinary Learning Outcome	FABE Lead	HCS Lead
			IITT 2.1.a - Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture		
16	**8**	Precision Conservation Management	IITT ELO 1.2.a Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture IITT 2.1.a - Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture	X	
17	**9**	Controlled Environment Agriculture	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture IITT 2.1.a - Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective Lecture	X	X
18	**9**	Tracking Weather and Climate Change	IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture IITT 2.1.a - Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture		X
	10	Spring Break			
	10	Spring Break			

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Teaching Schedule and Interdisciplinary Learning Outcomes

Lec#	Week	Class (3586)	Interdisciplinary Learning Outcome	FABE Lead	HCS Lead
19	**11**	Precision Livestock Farming Systems	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture IITT 2.1.a - Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture	X	X
20	**11**	Managing Pasture Based Livestock Systems	IITT ELO 1.1.b Analysis: Interpret and evaluate information from multiple sources and multiple disciplinary perspectives to develop a comprehensive analysis or synthesis, and thoroughly question the viewpoints of experts and professionals. Lecture IITT ELO 1.1.c Critical thinking & analysis Systematically and methodically analyze their own and others' assumptions using more than one disciplinary lens and carefully evaluate the relevance of contexts when representing a position. Lecture Lecture IITT ELO 1.2.a Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture IITT 2.1.a - Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture		X
21	**12**	Crop and Animal Modeling	IITT 1.1.b - Analysis: Interpret and evaluate information from multiple sources and multiple disciplinary perspectives to develop a comprehensive analysis or synthesis, and thoroughly question the viewpoints of experts and professionals. Lecture		X

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			IITT 1.1.c - Critical thinking & analysis Systematically and methodically analyze their own and others' assumptions using more than one disciplinary lens and carefully evaluate the relevance of contexts when representing a position. Lecture IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture		
22	**12**	Precision Irrigation and Controlled Drainage for Enhance Water Quality	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture IITT ELO 2.1.a Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture	X	X
23	**13**	Internet of Things (IoT) and Sustainability	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture IITT ELO 2.2.b. Empathy: Interpret and explain the issue under consideration from the perspectives other than their own and more than one worldview and demonstrates openness towards others in the academic community and their perspectives. Lecture		X
24	**13**	On-Farm Research and its role in Digital Agriculture.	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture IITT 1.1.b - Analysis: Interpret and evaluate information from multiple sources and multiple disciplinary perspectives to develop a comprehensive analysis or	X	X

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			synthesis, and thoroughly question the viewpoints of experts and professionals. Lecture IITT 1.1.c - Critical thinking & analysis Systematically and methodically analyze their own and others' assumptions using more than one disciplinary lens and carefully evaluate the relevance of contexts when representing a position. Lecture IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture		
25	**14**	Data Analytics and Visualization for Digital Agriculture	IITT 1.1.b - Analysis: Interpret and evaluate information from multiple sources and multiple disciplinary perspectives to develop a comprehensive analysis or synthesis, and thoroughly question the viewpoints of experts and professionals. Lecture IITT 1.1.c - Critical thinking & analysis Systematically and methodically analyze their own and others' assumptions using more than one disciplinary lens and carefully evaluate the relevance of contexts when representing a position. Lecture IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture		X
26	**14**	AI in Marketing and Agricultural Supply Chain Logistics	IITT 2.1.a - Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture IITT ELO 2.2.a Self-awareness: Evaluates the impacts of cross disciplinary synthesis of the issue on themselves, the scholarly inquiry, the local and global systems and also considers the long-term impact of the work. Lecture		X
27	**15**	Application of Blockchain Technology in	IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture		X

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		Agricultural Supply Chain	IITT 2.1.a - Integration of knowledge: Connect, analyze, and extend knowledge (facts, theories, etc.) from course content to integrate their insights through construction of a more comprehensive perspective. Lecture		
28	**15**	Enterprise Agriculture and Sustainability	IITT 1.1.a - Critical thinking: Clearly state and comprehensively describe the issue or problem under consideration, delivering all relevant information necessary. Lecture IITT 1.1.b - Analysis: Interpret and evaluate information from multiple sources and multiple disciplinary perspectives to develop a comprehensive analysis or synthesis, and thoroughly question the viewpoints of experts and professionals. Lecture IITT 1.1.c - Critical thinking & analysis Systematically and methodically analyze their own and others' assumptions using more than one disciplinary lens and carefully evaluate the relevance of contexts when representing a position. Lecture IITT 1.2.a - Scholarly engagement: Articulate a thorough and complex understanding of the factors and contexts, including natural, social, cultural and political, contributing to an integrative understanding of the issue. Lecture IITT ELO 2.1.b Multiple perspectives: Evaluate and apply diverse perspectives to complex subjects from multiple cultural and disciplinary lenses as appropriate. Lecture	X	X
		Finals			

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Teaching Schedule and Interdisciplinary Learning Outcomes

Interaction between the co-instructors:

For the 28 lectures in the term, 15 lectures will be co-led by individual instructors (seven from FABE and eight from HCS) to allow for integration of content presented in previous and current sessions. Thirteen lectures will be led by individual instructors to discuss their disciplinary expertise.

- Instructors will share grading duties and base scoring on defined criteria.
- Instructors will meet weekly outside of class to discuss content and review plans for integration of lectures.