PA211

Applications in Precision Farming

3 Credits

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Applications in Precision Farming

Calendar Description

This course provides an overview of precision farming techniques and the equipment used to implement these techniques. Differential Global Positioning Systems (DGPS) receivers, yield monitors, variable rate application equipment, remote sensing techniques, and field scouting computers are studied and used to collect data used for making crop planning decisions.

Rationale

This is a required course for the Crop Technology students. Global Positioning Systems (GPS) and Geographical Information Systems (GIS) are increasingly used by producers and consultants in the agricultural industry. GPS and GIS systems are used in all operations including seeding, spraying, fertilizer application, field scouting and harvesting. This course introduces the student to the science of Global Positioning Systems (GPS) and investigates Geographical Information Systems (GIS) at a depth to prepare the student to productively use this technology in the workplace to help solve spatial and temporal problems within agricultural land. Students develop skills that allow them to select and use appropriate GPS equipment and common GIS software packages. Using GIS, student can isolate and investigate fertility, weed, insect, and soil problems and seek timely and effective solutions. These same technologies are used for environmental land management. Employment opportunities exist for people with knowledge of agronomy, soil science and precision farming techniques to offer consulting and data management services to producers.

Prerequisites

None

Co-Requisites

None

Course Learning Outcomes

Upon successful completion of this course, student will be able to

1. identify where and why Precision Farming is practiced in Agriculture.

Objectives

a. provide a list of farming activities which can be included within the scope of Precision Farming
b. define Precision Farming as an on-going process.
c. recall three major applications of Precision Farming
d. identify three major reasons why farmers adopt and practice PF
e. evaluate anticipated benefits and costs of adopting PF
f. express the concepts of Measurements and Management of Variability as PF practice cornerstones.

2. explain how satellite global positioning (GPS) can be used to determine a position on the Earth.

Objectives

a. differentiate between GNSS and GPS
b. identify five steps or requirements to determine a body's position in space using a GNSS.
c. describe factors that limit the precision of a GPS measurement.
d. describe ways of differentially correcting a GPS measurement to increase the accuracy.
e. categorize types of DGPS "Correction Services" available.

3. describe common applications of DGPS position based machine and input control.

Objectives

a. describe GPS guidance and auto-steer devices and list the advantages of their use.
b. use "Guidance only" DGPS control systems to set operational passes, mark features, and return to marked features in college fields.
c. experiment with steering control systems on college equipment.
d. describe the principles and equipment used for sectional control and variable rate application of seed, fertilizer and pesticides.
e. predict and verify the input (cost) savings potential of sectional machine control.

4. explain the value of gathering, storing, and mapping DGPS tagged data in a GIS (Geographic Information System).

Objectives

a. define GIS.
b. use hand-held and equipment-mounted GPS data collection equipment to collect spatial information in the field and transfer the data to a desktop computer for analysis.
c. describe the types of data that can be used within a GIS software package.
d. describe the principles of operation of combine yield and moisture measurement devices.
e. import data and combine yield files into a GIS software package.
f. map agricultural GIS data using industry accepted practices and conventions.
g. describe common coordinate and map projection systems.
h. create profit maps on college fields based on harvested yield and fixed and spatially variable expenses.
i. demonstrate the use of precision farming data for in field experimentation.

5. explain the use of remote sensing data to aid farming decisions.

Objectives

a. define Remote Sensing giving common examples of its application in agriculture.
b. differentiate Real Time "on-the-go" sensing applications from map-based remote sensing applications.
c. use aerial and infrared photographs within a GIS to aid management decisions.
d. describe the use of UAQVs "drones" as a remote sensing platform
e. use satellite imagery and UAV derived imagery to aid management decisions.
f. identify problem areas in an agricultural field using GIS data and query techniques.
g. create thematic maps that would communicate problems to a farmer or client.
h. generate a prescription map, based on remote sensed and harvest yield data, suitable to be used in modern variable rate application equipment.

Resource Materials

Required Text(s):

There are no required textbooks for this course. Required reading assignments are posted or linked on the course web page (D2L).

Reference Text(s):

Reference reading material is posted or linked on the course web page (D2L).

Conduct of Course

This course consists of 42 hours of lecture and 12 hours of lab. Lab time consists of a combination of outdoor and in field equipment use and/or data collection and computer lab activities. Students collect data in the field using GPS equipment and farm machinery then complete assignments using GIS software.

Course information, including lecture note summaries, is available to the student on the course D2L website. Students are encouraged to check the course web page frequently for new material, assignments, and announcements. In addition to smaller assignments, students complete a major group mapping project that incorporates all class topics.

Evaluation Procedures

The student's final grade is an aggregate of the following components:

GIS application mapping and data collection labs, assignments and quizzes	30%
Participation	5%
Group GIS Project	12%
Student Panel	5%
Midterm exam	20%
Final exam	28%
	100%

All assignments and projects must be completed to receive a grade for the course. The comprehensive final exam covers all course material including lecture, lab and project topics.

Marks are converted to a grade point according to the following scale:

Grade Equivalents and Course Pass Requirements

A minimum grade of D (50%) (1.00) is required to pass this course.

Letter	F	D	D+	C-	C	C+	B-	B	B+	A-	A	A+
Percent Range	0-49	50-52	53-56	57-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-100
Points	0.00	1.00	1.30	1.70	2.00	2.30	2.70	3.00	3.30	3.70	4.00	4.00

Students must maintain a cumulative grade of C (GPA - Grade Point Average of 2.00) in order to qualify to graduate.

Attendance

Classroom and laboratory attendance is considered vital to the learning process and as significant to the students' evaluation as examinations and reports.

a. Students having a combination of excused and/or unexcused absence of 20 percent or higher for the scheduled course hours will be required to withdraw and will automatically receive a "RW" (required withdrawal) for the course, regardless of any other evaluation results. (RW is a failing grade.)
b. An excused absence is one that is verified with your Instructor. Verification should be prior to the absence or the next class day following the absence. Verification of the absence may take the form of a note from your doctor/College nurse regarding illness, or a note from another Instructor regarding a field trip or other activity, or authorization by your Instructor. An unexcused absence is anything NOT verified by the instructor prior to the absence or the next class day following the absence.

NOTE: Any exceptions to the above attendance policy (e.g. timetable conflicts, work-related issues) must be approved in writing by the Department Chair prior to the beginning of the course.

It is the students' responsibility to know their own absentee record.

Normal hours are 8:30 a.m. to 6:30 p.m., with potential for evening courses, exams or extended field trips. Students are expected to be available for classes during these times.

Course Units/Topics

1. Where and why Precision Farming is practiced in Agriculture.
2. Satellite global positioning (GPS) used to determine a position on the Earth.
3. Common applications of DGPS position based machine and input control.
4. The value of gathering, storing, and mapping DGPS tagged data in a GIS (Geographic Information System).
5. The use of remote sensing data to aid farming decisions.

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