

25UAGT414	SENSORS AND AI IN PRECISION AGRICULTURE	Category	L	T	P	R	Credit	Year of Introduction
		PEC	3	0	0	0	3/5	2025

Preamble: This course introduces modern sensing technologies and Artificial Intelligence (AI) applications in precision agriculture. It integrates IoT, machine learning, remote sensing, robotics, and decision support systems for sustainable agricultural production.

Prerequisite: Nil

Course Outcomes: After the completion of the course, the student will be able to

CO	Course Outcomes	Knowledge Level
CO1	Explain the working principles of various sensors and detector materials used in precision agriculture.	K2 Understand
CO2	Integrate, and calibrate appropriate sensors and biosensors for agricultural and environmental monitoring applications.	K2 Understand
CO3	Apply Artificial Intelligence techniques and optimization methods to solve agricultural problems.	K3 Apply
CO4	Apply AI-enabled precision agriculture solutions for crop and food quality assessment.	K3 Apply

Mapping of course outcomes with program outcomes and program specific outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	3	2
CO2	3	3	2	2	3	-	-	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	3	3
CO4	3	3	3	2	3	3	-	-	-	-	-	3	3
Avg	3	2.75	2.25	2	3	3	-	-	-	-	-	3	2.75

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Mapping of Course Outcomes with Knowledge and Attitude Profile (WK)

CO	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	*	*	*	*	*			*	
CO2	*	*	*	*	*	*		*	
CO3	*	*	*	*	*	*		*	
CO4	*	*	*	*	*	*	*	*	

Wks Mapped with the Course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
*	*	*	*	*	*	*	*	

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	40	60	2.5 hrs

Continuous Internal Evaluation Pattern

Attendance	: 5 Marks
Continuous Assessment Assignment/ Field visit report	: 15 Marks
Evaluate	: 5 Marks
Analyze	: 5 Marks
Viva Voce	: 10 Marks
Total	: 40 Marks

SYLLABUS**Module 1 (10 Hours)**

Introduction to sensors and transducers, Need for sensors in agriculture, Sensor classification; Units of measurement; Sensor Characteristics; First-order and second-order sensor models; Sensor Working Principles; Detector materials and their characteristics, Fundamentals of spectroscopy; Basics of remote sensing and data acquisition

Module 2 (10 Hours)

Physical and Mechanical Sensors; Velocity and acceleration sensors; Optical and electromagnetic wave detectors, Capacitance sensors, Weather sensors and imaging sensors, Soil moisture and soil temperature sensors; Biosensors: Components, Nanomaterials, Applications in agriculture and food quality; Sensor Selection and Integration, Calibration and signal conditioning, Data acquisition systems, IoT-based sensor networks in precision agriculture, Sensor-driven precision nutrient management

Module 3 (12 Hours)

Definition and Scope of Artificial Intelligence: Narrow AI, Machine Learning (ML), Deep learning (DL), and their distinctions. Evolution of AI in Agriculture: from rule-based expert systems to data driven Agriculture 4.0/5.0. Types of Machine Learning: Supervised and Unsupervised learning; Machine Learning fundamentals and Algorithms in Precision Farming: Linear/ Logistic regression, Decision trees, Random Forest, Support Vector Machines (SVM), Clustering (K-means).

Module 4 (10 Hours)

IoT-enabled water level monitoring, specific nutrient and fertilizer management, AI-based irrigation scheduling; Smart Monitoring and Automation; Drone and Imaging Applications, Crop and Livestock Management; Weed detection and management; Disease detection; Drought and flood prediction, Carbon footprint monitoring; Smart cold storage monitoring, Case studies and future trends.

Field visit

Field visits to Precision Farming Demonstration Farm/ Agri-Tech Startup / Smart Farming Company/ Weather Monitoring / Agro-Meteorological Station/ Smart Greenhouse / Protected Cultivation Unit/ Food Processing & Quality Control Lab / Drone & Remote Sensing Centre

Text Books

1. Patranabis, D. (2010). *Sensors and transducers*. PHI Learning Private Limited.
2. Russell, S., & Norvig, P. (2021). *Artificial intelligence: A modern approach* (4th ed.). Pearson Education.
3. Zhang, Q. (2016). *Precision agriculture technology for crop farming*. CRC Press.

Reference Books

1. Kerry, R., & Escolà, A. (Eds.). (2022). Sensing approaches for precision agriculture (Progress in Precision Agriculture). Springer Nature Switzerland AG. ISBN-10: 3030784339; ISBN-13: 978-3030784331.
2. Doebelin, E. O., & Manik, D. N. (2021). *Measurement systems: Application and design*. McGraw Hill Education.
3. Lillesand, T. M., Kiefer, R. W., & Chipman, J. W. (2020). *Remote sensing and image interpretation*. Wiley India Pvt. Ltd.

**END SEMESTER EXAMINATION - MODEL QUESTION PAPER
(STC 2025 SCHEME)**

Course Code	25UAGT414
Course Name	SENSORS AND AI IN PRECISION AGRICULTURE
Max. Marks: 60	Duration: 2.5 Hours

Part A (Answer all questions. Each question carries 3 marks)				
Qn No.	Question	Marks	CO	BL
1.	Explain the need for sensors in precision agriculture.	3	CO1	L2
2.	Describe first-order and second-order sensor models.	3	CO1	L2
3.	Explain the components of a biosensor.	3	CO2	L2
4.	Explain the calibration and signal conditioning of a sensor.	3	CO2	L2
5.	Differentiate between machine learning and deep learning.	3	CO3	L2
6.	Apply supervised learning to explain a crop prediction problem.	3	CO3	L2
7.	Apply AI techniques to explain weed detection in a field.	3	CO4	L2
8.	Apply AI-enabled solutions to explain crop disease detection.	3	CO4	L2
Part B (Answer any one full question from each Module. Each question carries 9 marks)				
Module I				
Qn No.	Question	Marks	CO	BL
9	Explain the classification, characteristics and working principles of sensors used in precision agriculture.	9	CO1	L2
OR				
10	Explain the fundamentals of spectroscopy and the basics of remote sensing and data acquisition.	9	CO1	L2
Module II				
Qn No.	Question	Marks	CO	BL
11	Explain the working and integration of soil moisture and weather sensors for agricultural monitoring.	9	CO2	L2
OR				
12	Explain the components and agricultural applications of biosensors and nanomaterial-based detectors.	9	CO2	L2
Module III				
Qn No.	Question	Marks	CO	BL
13	Apply machine learning algorithms to explain how an agricultural prediction problem is solved in precision farming.	9	CO3	L3

OR				
14	Explain the evolution of AI in agriculture from rule-based expert systems to data-driven Agriculture 4.0/5.0.	9	CO3	L3
Module IV				
Qn No.	Question	Marks	CO	BL
15	Apply AI-enabled precision agriculture solutions to explain crop and food quality assessment.	9	CO4	L3
OR				
16	Apply imaging and drone applications to explain crop and livestock management and disease detection.	9	CO4	L3
