Course Code	Course Name	Credits
26BY111	ARTIFICIAL INTELLIGENCE IN PLANT SCIENCE AND AGRICULTURE	04

Course Objectives

- Describe the concepts, components, evolution, and recent advances of Artificial Intelligence in agriculture and its role in modern farming systems.
- Differentiate machine learning and deep learning techniques and apply AI tools for crop monitoring, plant phenomics and agricultural automation.
- Analyze AI-based plant phenotyping technologies, imaging techniques and their applications in crop improvement and stress assessment.
- Evaluate the use of AI in plant disease detection and precision agriculture, including yield prediction, resource management and implementation challenges.

Learning Outcomes

Upon successful completion of this course it is intended that a student will be able to:

- Understand the principles, evolution and applications of Artificial Intelligence in agriculture.
- Classify machine learning and deep learning methods used in crop monitoring, automation and phenomics.
- Examine AI-driven plant phenotyping and disease detection systems for crop improvement and protection.
- Analyze precision agriculture technologies, predictive analytics and challenges in AI adoption for sustainable farming.

Unit 1 - Foundations and Evolution of Artificial Intelligence in Agriculture (12 Hrs.)

Concept and components of Artificial Intelligence (AI), Evolution of AI in agricultural research, Recent advances in AI, Role of AI in modern agricultural systems.

Unit II - Machine Learning, Deep Learning and Agricultural Automation (12 Hrs.)

Concept and types of machine learning, Deep learning models used in plant phenomics, Machine learning tools for crop monitoring and field management, Automation in agricultural machinery and smart farming.

Unit III - Artificial Intelligence-Based Plant Phenotyping Technologies (12 Hrs.)

Concept and importance of plant phenotyping, High-throughput field phenotyping techniques, Imaging technique in plant assessment studies, Applications of phenomics in crop improvement and stress analysis.

Unit IV - Artificial Intelligence in Plant Disease Detection (12 Hrs.)

Traditional methods of plant disease detection and management, Steps involved in automated plant disease detection, Integration of big data analytics in AI-driven plant disease management, Limitations of AI-based disease detection systems.

Unit V - Artificial Intelligence in Precision Agriculture (12 Hrs.)

Application of AI in precision agriculture, Predictive analytics for crop yield optimization, Major considerations in developing AI systems for agriculture, Challenges in implementing AI in agriculture and strategies for mitigation.

Reference:

1. Gill, T., Gill, S. K., Saini, D. K., Chopra, Y., de Koff, J. P., & Sandhu, K. S. (2022). High throughput phenotyping and machine learning for plant stress phenotyping. Phenomics, 2(3), 156–183.
2. Jafar, A., Bibi, N., Naqvi, R. A., Sadeghi-Niaraki, A., & Jeong, D. (2024). Artificial intelligence in plant disease detection: Methods, applications and limitations. Frontiers in Plant Science, 15, 1356260.
3. Thomasson, J. A., Ampatzidis, Y., Bhandari, M., et al. (2025). Artificial Intelligence in Agriculture: Opportunities, Challenges and Recommendations. Council for Agricultural Science and Technology.
4. Titirmare, S., Margal, P. B., Gupta, S., & Kumar, D. (2024). AI-Powered Predictive Analytics for Crop Yield Optimization. CRC Press.
5. Wang, T., Tong, R., Xu, T., Li, Y., & Chen, Y. (2026). Artificial intelligence in plant science: Image-based phenotyping and trait prediction. Frontiers in Plant Science, 16.
6. Yang, W., Feng, H., Zhang, X., et al. (2020). Crop phenomics and high-throughput phenotyping: Challenges and future perspectives. Molecular Plant, 13(2), 187–214.
7. Kamilaris, A., & Prenafeta-Boldú, F. X. (2018). Deep learning in agriculture: A survey. Computers and Electronics in Agriculture, 147, 70–90.
8. Liakos, K. G., Busato, P., Moshou, D., Pearson, S., & Bochtis, D. (2018). Machine learning in agriculture: A review. Sensors, 18(8), 2674.
9. Russel, S., & Norvig, P. (2021). Artificial Intelligence: A Modern Approach, 4th Edition. Pearson.
10. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.