



**Institute of Botany**  
**Faculty of Life Sciences**  
**University of the Punjab, Lahore**  
**Course Outline**  
**Semester – VI**



Programme	BS Botany	Course Code	Bot-320	Credit Hours	3 (3-0)
<b>Course Title</b>	<b>Artificial Intelligence in Botany</b>				
<b>Course Introduction</b>					
This course is designed to incorporate artificial intelligence (AI) in Botany, a cutting-edge software technology that has revolutionized every sector of human life. The course contains a comprehensive basic knowledge of AI techniques. The course provides aspects related to AI research, AI development, and AI innovation in plant sciences that can help in learning how to manage complex integration of interdisciplinary branches of Botany.					
<b>Learning Outcomes</b>					
On the completion of the course, the students will:					
<ul style="list-style-type: none"> <li>• Enable students to learn about major AI tools currently available</li> <li>• Help student learn AI-assisted approaches in plant sciences -based research projects with different AI tools</li> <li>• Make students understand potential challenges and limitations of AI-assisted learning in plant sciences, more specifically of machine learning (ML) and deep learning (DL) driven analyses</li> <li>• Enable students to realize potential impacts of AI on the ethical, social and legal issues related to plant sciences</li> </ul>					
<b>Course Contents</b>					
<b>Introduction</b>					
Introduction to AI and its importance in Botany. Historical overview of AI-based work in Botany. Current developments in AI based research work in plant sciences. Emerging trends in AI-based techniques in Botany.					
<b>AI in Botany</b>					
Limited memory AI. Relative machines-based AI. Knowledge representation. Machine Learning. Regression. Tree-based methods. Deep learning. Neural networks.					
<b>Use of Robotics in AI</b>					
Robotics in AI. Reinforcement learning. Robotics in agriculture					
<b>AI languages and coding strategies</b>					
Introduction to Python, Julia, Java Script. Data preparation. Algorithm selection and Coding.					
<b>Machine learning and reasoning</b>					
Model Validation. Bias/variance tradeoff. Cross-validation. Hyperparameters					
<b>Ethical considerations</b>					
Potential ethical, social and legal issues of AI application in plants sciences and agriculture					
<b>Application of AI approaches in Botany</b>					
<ul style="list-style-type: none"> <li>• Protein-structure based machine learning</li> <li>• Machine learning for the prediction of meiotic recombination in plants</li> <li>• Study of ecology and evolution with modern advances in statistics and computation</li> <li>• Potential of omics data in predicting gene association with abiotic and biotic stress-resistant traits using machine learning</li> <li>• AI in plant growth prediction and environmental monitoring.</li> <li>• AI in plant disease detection and management.</li> <li>• Machine learning techniques for plant identification and classification.</li> <li>• Genomic data analysis in botany using AI.</li> </ul>					
<b>Case studies related AI-based projects in Botany</b>					
<ul style="list-style-type: none"> <li>• Monitoring spatial and temporal variation in vegetation distribution</li> </ul>					

- Monitoring industrial waste pollution generation and its management through AI tools
- Integrated analytics and machine learning for water quality index assessment

**Textbooks and Reading Material**

**1. Textbooks.**

1. Publishing, A. (2020). Python Machine Learning for Beginners: Learning from Scratch NumPy, Pandas, Matplotlib, Seaborn, Scikitlearn, and TensorFlow for Machine Learning and Data Science. Estonia: AI Publishing LLC.
2. Tensor, O. (2020). Machine Learning for Beginners: The Beginner's Guide to Understand Artificial Intelligence, Business Applications, and Machine Learning for Business: Includes Deep Learning and Data Science for Business. (n.p.): Francesca Bandu.
3. Chatterjee, I. (2021). Machine Learning and Its Application: A Quick Guide for Beginners. (n.p.): Bentham Science Publishers.
4. Zhang, A., Lipton, Z. C., Li, M., Smola, A. J. (2023). Dive Into Deep Learning. India: Cambridge University Press.
5. Russell, S. J., Norvig, P., Davis, E. (2009). Artificial Intelligence: A Modern Approach. United Kingdom: Prentice Hall.
6. Kelleher, J. D., Mac Namee, B., D'Arcy, A. (2020). Fundamentals of Machine Learning for Predictive Data Analytics, Second Edition: Algorithms, Worked Examples, and Case Studies. United Kingdom: MIT Press.

**Teaching Learning Strategies**

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| <ul style="list-style-type: none"> <li>• Interactive lecturing by the designated course instructor</li> <li>• Brainstorming sessions/Case studies</li> <li>• Class discussions</li> </ul> | <ul style="list-style-type: none"> <li>• Practice exercises</li> <li>• Arranging class lectures with veteran field experts</li> </ul> |
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**Assignments: Types and Number with Calendar**

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| <ul style="list-style-type: none"> <li>• Assignment Group (Before Mid Term)</li> <li>• Group Presentation</li> </ul> | <ul style="list-style-type: none"> <li>• Assignment Group (Before Final Term)</li> <li>• Group Presentation</li> </ul> |
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