

# TABLE OF CONTENTS

Unit No.	Title	Page No.
1	<b>Introduction to AI and Plant Biology</b>	1-16
	1.1 Overview of Artificial Intelligence	
	1.2 Basics of Plant Biology	
	1.3 Intersection of AI and Plant Sciences	
	1.4 Evolution of Smart Agriculture	
	1.5 Role of Data in Plant Biology	
	1.6 Current Research Trends	
	1.7 Challenges and Opportunities	
	1.8 Future Scope of AI in Plant Biology	
2	<b>Plant Data Acquisition and Management</b>	17-39
	2.1 Types of Plant Biological Data	
	2.2 Sensors and IoT in Agriculture	
	2.3 Remote Sensing and Satellite Data	
	2.4 Image and Video Data Collection	
	2.5 Genomic and Phenotypic Data	
	2.6 Data Storage Techniques	
	2.7 Data Quality and Integrity	
	2.8 Big Data in Plant Biology	
3	<b>Data Preprocessing and Feature Engineering</b>	40-61
	3.1 Data Cleaning Methods	
	3.2 Noise Reduction Techniques	
	3.3 Handling Missing Data	
	3.4 Feature Extraction from Images	
	3.5 Feature Selection Techniques	
	3.6 Data Normalization	
	3.7 Dimensionality Reduction	
	3.8 Real Time Data Processing	
4	<b>Machine Learning Techniques for Plant Analysis</b>	62-88
	4.1 Supervised Learning Models	
	4.2 Unsupervised Learning Models	
	4.3 Regression and Classification	
	4.4 Clustering in Plant Data	

	4.5	Decision Trees and Random Forests	
	4.6	Support Vector Machines	
	4.7	Model Evaluation Metrics	
	4.8	Case Studies in Crop Analysis	
5		<b>Deep Learning in Plant Biology</b>	89-121
	5.1	Introduction to Deep Learning	
	5.2	Convolutional Neural Networks	
	5.3	Recurrent Neural Networks	
	5.4	Transfer Learning for Plant Images	
	5.5	Object Detection in Plants	
	5.6	Segmentation of Plant Parts	
6		<b>Computer Vision for Plant Phenotyping</b>	122-152
	6.1	Digital Phenotyping Concepts	
	6.2	Leaf and Root Analysis	
	6.3	Growth Monitoring Techniques	
	6.4	Stress and Disease Detection	
	6.5	3D Plant Modelling	
	6.6	Time Series Image Analysis	
	6.7	Automated Phenotyping Systems	
	6.8	Accuracy and Validation	
7		<b>AI Based Plant Disease and Pest Management</b>	153-180
	7.1	Types of Plant Diseases	
	7.2	Pest Identification Using AI	
	7.3	Early Disease Prediction Models	
	7.4	Image Based Diagnosis	
	7.5	Decision Support Systems	
	7.6	Precision Spraying Techniques	
	7.7	Yield Loss Estimation	
	7.8	Case Studies	
8		<b>AI in Crop Yield Prediction and Optimization</b>	181-206
	8.1	Factors Affecting Crop Yield	
	8.2	Predictive Analytics Models	
	8.3	Weather and Climate Data Integration	
	8.4	Soil Health Assessment	

	8.5	Nutrient Management Systems	
	8.6	Irrigation Optimization	
	8.7	Harvest Planning	
	8.8	Sustainable Yield Improvement	
9		<b>Ethical, Environmental, and Societal Aspects</b>	207-230
	9.1	Ethics in AI Applications	
	9.2	Data Privacy in Agriculture	
	9.3	Environmental Impact Assessment	
	9.4	Bias and Fairness in Models	
	9.5	Farmer Adoption Challenges	
	9.6	Policy and Regulatory Frameworks	
	9.7	Socio Economic Impacts	
	9.8	Responsible AI Practices	
10		<b>Future Trends and Research Directions</b>	230-252
	10.1	AI and Plant Genomics	
	10.2	Robotics in Agriculture	
	10.3	Autonomous Farming Systems	
	10.4	Edge AI for Smart Farms	
	10.5	Integration with Blockchain	
	10.6	Climate Resilient Agriculture	
	10.7	Open Research Challenges	
	10.8	Future Career Opportunities	