

TABLE OF CONTENTS

Chapter No.	Title	Page No.
I	INTRODUCTION TO WIRELESS SENSOR NETWORKS	1-22
	1.1 Overview of Wireless Sensor Networks (WSNs)	
	1.2 WSN Architecture and Components	
	1.3 Types of WSNs (Terrestrial, Underground, Underwater and Mobile)	
	1.4 Applications of WSN in Agriculture, Healthcare, Military and Smart Cities	
	1.5 Challenges in WSN: Energy, Scalability, Deployment and Communication	
II	WSN COMMUNICATION AND PROTOCOLS	23-43
	2.1 Network Topologies: Star, Tree, Mesh	
	2.2 Medium Access Control (MAC) Protocols for WSNs	
	2.3 Routing Protocols in WSNs – Flat, Hierarchical and Location-Based	
	2.4 Data Aggregation and Dissemination	
	2.5 Energy-Efficient Communication Strategies	
III	MACHINE LEARNING BASICS FOR WSN	44-54
	3.1 Introduction to ML: Supervised, Unsupervised and Reinforcement Learning	
	3.2 ML Pipeline for WSN: Data Collection, Preprocessing and Model Training	
	3.3 Sensor Data Characteristics and Challenges in Applying ML	
	3.4 Feature Engineering in Sensor Data	
IV	ML-BASED ROUTING ALGORITHMS	55-68
	4.1 Introduction to Intelligent Routing in WSN	
	4.2 ML-Based Routing Approaches: Q-Learning, Deep Q-Networks (DQN) and Reinforcement Learning	
	4.3 Energy-Aware and Delay-Sensitive Routing using ML	
	4.4 Case Studies and Simulation Tools (e.g., NS-3, OMNeT++, MATLAB)	
V	ML-BASED CLUSTERING TECHNIQUES IN WSN	69-89
	5.1 Role of Clustering in WSN (Energy-Saving, Scalability)	
	5.2 K-Means, Hierarchical Clustering and Fuzzy C-Means in WSNs	
	5.3 Adaptive Clustering using Reinforcement Learning	
	5.4 ML-based CH (Cluster Head) Selection Methods	
	5.5 Performance Analysis of ML-based Clustering vs Traditional Methods	

VI	SECURITY AND APPLICATIONS	90-102
	6.1 Security Issues in WSN and ML-Based Anomaly Detection	
	6.2 Intrusion Detection using Classification Models	
	6.3 Applications: Environmental Monitoring, SMART Farming, IoT Integration	
VII	LAB / PROJECT WORK	
	1. Simulation of ML-Based Routing in WSN using Python/MATLAB	103-111
	2. Implementation of Clustering Algorithms on Real-World Sensor Datasets	
	3. Energy Consumption Analysis of Traditional vs ML-Enhanced Protocols	
	4. Mini Project: Design a Smart WSN using ML for Real-Time Applications	