

TABLE OF CONTENTS

UnitNo.	Title	Page No.
1	Introduction to Mechatronics and Iot 1.1 Evolution of MechatronicSystems 1.2 Interdisciplinary Nature of Mechatronics: Mechanical, Electrical, Control, and Computing 1.3 Cyber-PhysicalSystems (CPS) 1.4 Introduction to IoT and Smart ConnectedProducts 1.5 Applications of Mechatronics and IoT in Industry and Society	01-15
2	System Modeling and Dynamics 2.1 Modeling of Mechanical, Electrical, and ElectromechanicalSystems 2.2 Translational and RotationalSystems 2.3 State-SpaceRepresentation 2.4 Linearization of NonlinearSystems 2.5 Block Diagrams and Signal Flow Graphs	16-28
3	Sensors and Transducers 3.1 Classification and Characteristics of Sensors 3.2 Displacement, Velocity, and AccelerationSensors 3.3 Force, Torque, and Pressure Sensors 3.4 Temperature and Flow Sensors 3.5 MEMS and Smart Sensors	29-45
4	Signal Conditioning and Data Acquisition 4.1 Signal Conditioning Circuits 4.2 Amplifiers, Filters, and Isolation 4.3 ADC and DAC Principles 4.4 SamplingTheorem and Quantization 4.5 Noise Sources and Reduction Techniques	46-62
5	Actuators and Drive Systems 5.1 DC, AC, Stepper, and Servo Motors 5.2 Motor Drive Circuits	63-76

	<ul style="list-style-type: none"> 5.3 Pneumatic and Hydraulic Actuators 5.4 Actuator Selection Criteria 5.5 Applications of Actuators in Automation 	
6	<p>Control Systems for Mechatronics</p> <ul style="list-style-type: none"> 6.1 Feedback and Closed-Loop Control 6.2 Time and Frequency Domain Analysis 6.3 PID Control and Tuning Methods 6.4 Stability and Performance Analysis 6.5 Introduction to Digital Control 	77-86
7	<p>Embedded Systems and Real-Time Control</p> <ul style="list-style-type: none"> 7.1 Microcontroller Architecture 7.2 Real-Time Operating Systems (RTOS) 7.3 Task Scheduling and Timing Constraints 7.4 Embedded Software Development Tools 7.5 Case Studies in Real-Time Mechatronic Systems 7.6 Embedded Communication Interfaces 	87-104
8	<p>Industrial Automation and Robotics</p> <ul style="list-style-type: none"> 8.1 PLC Architecture and Ladder Programming 8.2 Industrial Robots: Types, Kinematics, and Control 8.3 SCADA and HMI Systems 8.4 Safety Systems and Industrial Standards 	105-115
9	<p>IOT Architecture and Communication Technologies</p> <ul style="list-style-type: none"> 9.1 IoT System Architecture 9.2 IoT Communication Technologies & Protocols 9.3 Edge Computing and IoT Gateways 9.4 Comparison of IoT Communication Technologies (Numericals & Graphs) 9.5 Device, Gateway, and Cloud Layers 9.6 Communication Protocols: MQTT, HTTP, and CoAP 	116-132
10	<p>IOT Data Management and Analytics</p> <ul style="list-style-type: none"> 10.1 Data Acquisition and Storage 10.2 Data Processing and Analytics 10.3 Cloud Platforms and IoT Dashboards 10.4 AI/ML for IoT Analytics 10.5 Case Studies in IoT Analytics 	133-153

	10.6 Data Visualization Dashboards 10.7 Predictive Maintenance Applications	
11	Security, Standards, and Ethics 11.1 Security Challenges in IoT Systems 11.2 IoT Security Standards and Protocols 11.3 Ethical, Privacy, and Legal Issues in IoT	154-161
12	Applications, Case Studies, and Future Trends 12.1 Industry 4.0 and Smart Manufacturing 12.2 Smart Agriculture, Healthcare, and Transportation Applications 12.3 Future Trends in Mechatronics and IoT 12.4 Policy, Sustainability, and Societal Impact	162-172
13	Standards, Interoperability, and Compliance in Mechatronics & IoT 13.1 Introduction 13.2 Introduction to Standards, Interoperability, and Compliance in Mechatronics & IoT 13.3 Need for Standards in Mechatronics & IoT 13.4 Standardization Bodies and Their Roles	173-182
	Reference	183