NAAN MUDHALVAN – POLYTECHNIC – ODD SEMESTER 2025-26

COURSE CURRICULUM

IOT AND ITS APPLICATIONS

ABOUT THE COURSE

This course introduces students to the fundamentals of the Internet of Things (IoT) and its applications, enabling them to interface sensors with microcontrollers, collect and transmit real-time data, and integrate AI for intelligent decision-making. Through practical modules and use cases spanning agriculture, healthcare, automation, and urban infrastructure, students will develop and deploy smart IoT-AI applications. The program concludes with hands-on projects and a capstone to assess technical, problem-solving, and collaborative skills.

COURSE NAME:	IoT and its Applications
TOTAL DURATION:	60 HRS
MODE OF DELIVERY	PHYSICAL CLASSROOM TRAINING AT RESPECTIVE COLLEGES
TRAINER TO STUDENT RATIO:	1:60
TOTAL MARKS:	70 (External) + 30 (Internal)

TABLE 1	
OVERALL COURSE OBJECTIVE	• Apply the foundational concepts of the Internet of Things (IoT) in smart systems. • Interface and integrate various digital and analog sensors with IoT platforms. • Collect real-time data, processing, and wireless transmission using microcontrollers. • Implement AI/ML techniques for sensor data analysis and smart decision-making at the edge. • Build practical, scalable IoT-AI applications in sectors such as agriculture, healthcare, and automation.
LEARNING OUTCOME	• Evaluate the architecture and working of IoT systems and sensor networks. • Interface multiple sensors (temperature, humidity, motion, gas, etc.) with IoT development boards. • Collect, transmit, and visualize sensor data through cloud platforms like Blynk, ThingSpeak,

	or Firebase. • Apply AI models to classify, predict, or automate based on sensor data using tools like Edge Impulse or TensorFlow Lite. • Develop and deploy real-time IoT applications integrated with AI for smart monitoring and control.

TABLE 2: MODULE-WISE COURSE CONTENT AND OUTCOME				
SL. NO	**MODULE NAME**	**MODULE CONTENT**	**MODULE LEARNING OUTCOME**	**DURATION (60 HRS)**
1	**Fundamentals of IoT and Sensor Systems**	IoT architecture & ecosystem, Types of sensors (analog/digital), Microcontrollers for IoT (Arduino, ESP32), Power sources & safety	• Understand the basics of IoT systems and classify types of sensors used in real-time applications.	12 hrs
2	**Sensor Interfacing and Data Acquisition**	Interfacing temperature, humidity, gas, PIR, ultrasonic sensors, Analog to digital conversion, Signal conditioning	• Interface sensors with IoT boards and perform accurate data acquisition and signal conversion.	12 hrs
3	**Communication Protocols & IoT Networking**	Serial communication: UART, SPI, I2C Wireless protocols: Wi-Fi, Bluetooth, Zigbee. Introduction to MQTT/HTTP protocols IoT data formats (JSON)	• Implement communication between sensors, microcontrollers and cloud platforms using suitable protocols.	12 hrs
4	**AI for Sensor Data Processing**	Basics of AI and ML, Tools: Edge Impulse, TFLite Micro, Model training (classification/regression), Deployment on ESP32/Arduino	• Train and deploy lightweight AI models to perform real-time classification and decision-making on IoT devices.	12 hrs

5	**IoT System Development & Capstone Project and Case Studies**	Design and implementation of an IoT + AI solution. Use case exploration in agriculture, smart home, and health monitoring	• Apply knowledge to build and demonstrate a real-world IoT-AI integrated application with sensor data. • Design and develop a secure, functional IoT system and evaluate its real-world applicability.	12 hrs

TABLE 3: OVERALL COURSE LEARNING OUTCOME ASSESSMENT CRITERIA AND USE CASES		
LEARNING OUTCOME	**ASSESSMENT CRITERIA**	**USE CASES**
● Integrate environmental sensors for data-driven agricultural decisions	● Design a sensor system for soil and climate monitoring	**Use Case 1 - AI-Based Precision Agriculture & Crop Health Analytics** **Scenario:** A farm wants to automate irrigation. **Task:** Integrate soil moisture sensors with an IoT system to control water valves based on soil dryness.
● Implement IoT-based automation using environmental and presence sensors	● Integrate motion and temperature sensors into a smart home ecosystem	**Use Case 2 - Context-Aware Intelligent Home Control Systems** **Scenario:** A startup is developing energy-efficient homes. **Task:** Implement temperature and motion sensors to automate HVAC and lighting systems.

● Utilize predictive maintenance through sensor integration in IoT	● Deploy sensors for monitoring machine health and anomalies	**Use Case 3 - AI-Powered Predictive Maintenance & Process Automation** **Scenario:** A manufacturing plant aims to reduce downtime. **Task:** Deploy vibration and temperature sensors on machines to predict failures.
● Design real-time parking management systems using IoT	● Integrate ultrasonic sensors and wireless modules for occupancy detection	**Use Case 4 - Computer Vision & Sensor Fusion for Intelligent Parking Systems** **Scenario:** A city wants to improve parking availability. **Task:** Use ultrasonic sensors to detect parking slot occupancy and send data to a central server.
● Implement remote health monitoring systems using biosensors	● Design an IoT-based wearable to collect vital health data	**Use Case 5 -Edge AI for Vital Signs & Health Anomaly Detection** **Scenario:** A hospital wants to monitor patients remotely. **Task:** Use heart rate and oxygen saturation sensors integrated with IoT for continuous tracking.
● Analyse retail space efficiency using sensor data	● Integrate footfall and temperature sensors to measure customer experience	**Use Case 6 - AI-Driven Customer Behaviour Analytics & Inventory Prediction** **Scenario**: A retailer wants to optimize store layout. **Task:** Install footfall sensors and temperature sensors to analyse customer movement and comfort.

● Deploy gas and particulate sensors for continuous air quality monitoring	● Deploy gas and particulate sensors for continuous air quality monitoring	**Use Case 7 -Sensor-Integrated AI for Air/Water Quality Prediction** **Scenario:** A government agency needs air quality data. **Task:** Integrate gas and particulate sensors into a network for real-time pollution tracking.
● Monitor perishable goods using IoT and sensor technology	● Implement temperature and humidity sensors in logistics tracking	**Use Case 8 - Real-Time AI Monitoring for Cold Chain Integrity** **Scenario:** A logistics firm transports perishable goods. **Task:** Use temperature and humidity sensors to monitor and log storage conditions in real time.
● Detect and prevent water loss using sensor-integrated IoT systems	● Deploy flow and pressure sensors to monitor pipelines	**Use Case 9 -AI-Based Leak Detection & Consumption Forecasting** **Scenario:** A city faces water leakage issues. **Task:** Use flow and pressure sensors to detect leaks and automate pipeline monitoring.
● Design wearable systems with embedded sensors and wireless communication	● Integrate motion sensors for activity tracking.	**Use Case 10 -On-Device AI for Motion & Health Pattern Recognition** **Scenario:** A company is building fitness bands. **Task:** Integrate accelerometers and gyroscopes for activity and posture tracking.

● Optimize urban infrastructure using IoT-based sensor systems	● Implement light and motion sensors for adaptive lighting	**Use Case 11 - Adaptive Lighting using AI and Occupancy Sensing** **Scenario:** A municipality wants energy-efficient lighting. **Task:** Integrate light and motion sensors to control street lights based on pedestrian presence.
● Improve energy distribution efficiency using IoT-based monitoring	● Integrate voltage and current sensors for real-time grid diagnostics	**Use Case 12 - AI-Powered Load Forecasting and Energy Optimization** **Scenario:** An energy provider aims to improve power distribution. **Task:** Integrate voltage and current sensors for real-time load balancing.
● Design efficient waste collection systems using IoT	● Use level sensors to detect and report bin fill levels	**Use Case 13 - ML-Based Waste Detection and Smart Bin Monitoring** **Scenario:** A city wants to optimize waste collection. **Task:** Use level sensors in bins to detect fill level and notify collection teams.
● Develop early warning systems with environmental sensors	● Implement water level and rainfall sensors for flood detection	**Use Case 14 - Real-Time Sensor Analytics & AI for Disaster Prediction** **Scenario**: An area is prone to floods. **Task:** Integrate water level and rain sensors for early warning systems.

● Create intelligent learning environments using sensor technology	● Deploy ambient and presence sensors to manage campus utilities	**Use Case 15 - Integrated AI Systems for Energy, Security, and Facility Management** **Scenario:** A university wants a connected campus. **Task:** Deploy various environmental sensors for classroom comfort and smart energy usage.
● Monitor animal health through IoT sensor integration	● Implement movement and body temperature sensors for health tracking	**Use Case 16 -AI-Based Livestock Behaviour & Health Tracking** **Scenario:** A dairy farm wants better herd health. **Task:** Use temperature and movement sensors to monitor cows' health and behaviour.
● Track inventory movement in real-time using IoT sensors	● Deploy RFID and proximity sensors for automated stock tracking	**Use Case 17 - ML-Driven Inventory Forecasting & Real-Time Tracking** **Scenario:** A warehouse needs inventory tracking. **Task:** Use RFID and proximity sensors for real-time stock updates.
● Apply IoT sensor technology in forest resource management	● Design a network of environmental sensors for forestry analytics	**Use Case 18 - AI-Enabled Forest Monitoring & Deforestation Detection** **Scenario:** A forest department monitors tree health. **Task:** Deploy soil and environmental sensors to track forest conditions and growth trends.

● Monitor infrastructure safety using embedded sensors	● Install vibration and tilt sensors for structural condition analysis	**Use Case 19 - Sensor-Driven AI for Infrastructure Stress and Damage Analysis** **Scenario:** A civil engineering firm monitors bridges. **Task:** Install strain gauges and tilt sensors to assess structural integrity.
● Enable energy consumption analytics using sensor-enabled IoT	● Integrate electrical sensors for usage tracking and reporting	**Use Case 20 - AI-Based Consumption Pattern Analysis & Load Balancing** **Scenario:** A utility company upgrades metering. **Task:** Integrate current and voltage sensors with wireless modules for real-time consumption data.

TABLE 4: LIST OF FINAL PROJECTS (20 PROJECTS THAT COMPREHENSIVELY COVER ALL THE LEARNING OUTCOMES)	
S. NO.	**FINAL PROJECT (The Training Partner shall cover all the steps to complete a given project)**
1	AI-Based Precision Agriculture & Crop Health Analytics
2	Context-Aware Intelligent Home Control Systems
3	AI-Powered Predictive Maintenance & Process Automation
4	Computer Vision & Sensor Fusion for Intelligent Parking Systems
5	Edge AI for Vital Signs & Health Anomaly Detection
6	AI-Driven Customer Behaviour Analytics & Inventory Prediction
7	Sensor-Integrated AI for Air/Water Quality Prediction
8	Real-Time AI Monitoring for Cold Chain Integrity
9	AI-Based Leak Detection & Consumption Forecasting
10	On-Device AI for Motion & Health Pattern Recognition
11	Adaptive Lighting using AI and Occupancy Sensing
12	AI-Powered Load Forecasting and Energy Optimization
13	ML-Based Waste Detection and Smart Bin Monitoring

14	Real-Time Sensor Analytics & AI for Disaster Prediction
15	Integrated AI Systems for Energy, Security, and Facility Management
16	AI-Based Livestock Behaviour & Health Tracking
17	ML-Driven Inventory Forecasting & Real-Time Tracking
18	AI-Enabled Forest Monitoring & Deforestation Detection
19	Sensor-Driven AI for Infrastructure Stress and Damage Analysis
20	AI-Based Consumption Pattern Analysis & Load Balancing

TABLE 5: COURSE ASSESSMENT RUBRICS (TOTAL MARKS: 75)				
ASSESSMENT CRITERIA	**DESCRIBE THE CRITERIA OF THE BELOW CATEGORY PERFORMANCE**			**TOTAL MARKS**
	FAIR	**GOOD**	**EXCELLENT**	
Application of IoT Concepts & Sensor Integration	Basic application of IoT concepts; limited sensor knowledge	Clear application of IoT architecture and major sensor types	Deep application of protocols, sensor types, and integration strategies	15
Implementation of Concepts in Use Cases	Implements concepts with minimal real-world relevance	Implements concepts effectively to common scenarios	Implements concepts innovatively with high relevance and accuracy	20
Design and Implementation Skills, Problem-Solving, and Innovation	Basic design with limited integration or technical flaws Limited problem-solving; relies on predefined solutions.	Functional design with adequate sensor integration Shows initiative in solving problems using standard approaches	Well-structured, optimized design with excellent integration of sensors and IoT components Demonstrates creativity and innovation in solving complex, real-world challenges	15
Technical Report Documentation and Project Execution Demonstration	Poorly organized, lacks detail or clarity Partially working demo or simulation with major issues	Well-organized with sufficient detail Fully working demo with minor flaws	Professional, highly detailed, and technically accurate documentation Smooth, well-executed demo with strong justification and alignment to design goals	15

Teamwork and Collaboration, Presentation and Communication Skills	Rarely participates in group efforts Lacks clarity, limited visuals, and weak explanation	Contributes consistently to team activities Clear delivery with structured flow and basic visuals	Highly collaborative, takes initiative, and enhances team productivity Engaging, confident delivery with strong visual aids and clear articulation of technical details	5
Total				**70**