NAAN MUDHALVAN SYLLABUS

IoT AND ITS APPLICATIONS

Course Objectives

- Create a Project based real time scenario.
- Understanding the working principles of Sensors, Actuators, Controllers and various interfaces.
- Developing a cloud based scenario.
- Practical exposure to communication technologies like Wi-Fi and IoT Application protocol
- Build the IoT project.

Course Outcomes

- A team of 4 students to submit at least 3 different mini IOT application boards in addition to practical

On successful completion of the course, students will be able to:

- Design portable IoT applications using various platforms.
- Develop communication models and various protocols for IoT.
- Create cloud offerings related to IoT
- Develop applications of IoT in real time scenario

Semester / Branch	V / EEE
Total Duration	60 Hours
Mode of Delivery	Physical classroom training at the respective colleges.
Total Marks	70 (External) + 30 (Internal)

Course Syllabus:

Category	Course Code	Course Title	L	T	P	C
On Campus	XXXXXX	IOT AND APPLICATIONS	1	0	2	2

UNIT I : INTRODUCTION TO INTERNET OF THINGS (10 Hours)
Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT

UNIT II : COMPONENTS IN INTERNET OF THINGS (10 Hours)
Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee,Wifi, GPS, GSM Modules)

UNIT III : PROTOCOLS AND TECHNOLOGIES BEHIND IOT (11 Hours)
IOT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, Big Data Analytics, Cloud Computing, Embedded Systems - Use of data analytics and data science for decision making.

UNIT IV : OPEN PLATFORMS AND PROGRAMMING (11 Hours)
IOT deployment for various platforms -Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud - Use of generative AI to do coding and design.

UNIT V : IOT APPLICATIONS (10 Hours)
Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture - Debug of IoT boards.

Use Cases: (8 Hours)

List of Final Projects:

1. Smart Shirt for health monitoring
2. Waste Management System
3. Smart Parking System
4. Air Quality Monitoring

5. Smart Home Automation
6. Agricultural Crop Monitoring
7. Smart Energy Management
8. Disaster Early Warning System
9. Industrial Automation
10. Connected Vehicles
11. Home security Systems
12. Asset Tracking

CURRICULUM

Internet of Things and its Applications:

LEARNING OUTCOME	ASSESSMENT CRITERIA	USE CASES
• Integration of IoT devices for home automation. • Development of smart algorithms for energy optimization • Implementation of user-centric design for smart home interfaces.	Implement key IoT concepts, architectures, and components.	**Use Case 1: Smart Home Automation** **Scenario:** Smart Home Automation A homeowner wants to automate their home using IoT devices. **Task:** Students must assess the homeowner's requirements, design a smart home system using IoT devices such as smart thermostats, lights and implement the system to meet the homeowner's needs.
• Development of asset management systems. • Utilization of real-time monitoring for asset security and optimization.	Analysis and compare of different connectivity technologies for IoT applications.	**Use Case 2: Asset Tracking Solution** **Scenario:** Asset Tracking Solution A logistics company needs to track the movement of its fleet vehicles using IoT technology. **Task:** Students must evaluate various connectivity options (e.g., GPS, RFID, cellular) for tracking fleet vehicles, select the most suitable technology based on factors like accuracy and coverage, and implement the tracking system for the logistics company.

• Implementation of environmental monitoring systems.	Integrate sensors into IoT applications and data acquisition techniques.	**Use Case 3: Air Quality Monitoring** **Scenario:** Air Quality Monitoring An environmental agency wants to monitor air quality in urban areas using IoT sensors. **Task:** Students must select appropriate sensors for measuring air quality parameters such as particulate matter and pollutants, design a sensor network to cover urban areas effectively, and deploy the sensors to collect real-time data.
• Deployment of IoT sensors for agriculture. • Application of data-driven decision-making in agriculture.	Integrate IoT devices with cloud services for data storage, processing, and analysis.	**Use Case 4: Smart Agriculture Solution** **Scenario:** A farming cooperative wants to improve crop yield and resource utilization. **Tasks:** Students must design and deploy an IoT solution for precision agriculture, including soil moisture monitoring, automated irrigation, and crop health monitoring. They should showcase understanding of sensor integration, data processing, cloud services, and environmental monitoring.

• Integration of IoT sensors for machine monitoring. • Development of predictive maintenance algorithms.	Analyze IoT applications and deploy across various industries.	**Use Case 5: Industrial Automation** **Scenario:** Industrial Automation A manufacturing company aims to automate its production processes using IoT technology. **Task:** Students must conduct a feasibility study to identify potential areas for automation, design and implement IoT solutions for monitoring and controlling manufacturing processes (e.g., predictive maintenance, quality control), and integrate the solutions into the existing production environment.
• Development of automated parking systems. • Implementation of real-time data communication for vehicle tracking.	Implement key IoT concepts, architectures, and components.	**Use Case 6: Smart Parking System** **Scenario:** A city municipality wants to implement a smart parking system to reduce congestion and improve parking efficiency. **Task:** Students must design and implement a smart parking solution using IoT sensors to detect parking space availability, a mobile application for users to find and book parking spaces, and a central system to manage the data and provide analytics.

• Development of smart algorithms for energy optimization.	Analyze and compare different connectivity technologies for IoT applications.	**Use Case 7: Smart Energy Management** **Scenario:** A residential community wants to optimize energy usage and reduce electricity bills. **Task:** Students must design a smart energy management system using IoT devices to monitor and control energy consumption in real-time, integrating renewable energy sources and providing usage analytics through a mobile app.
• Integration of automated alert systems. • Implementation of emergency response protocols.	Analyze and compare different connectivity technologies for IoT applications.	**Use Case 8: Disaster Early Warning System** **Scenario:** A coastal city needs a disaster early warning system to mitigate the impact of natural disasters like tsunamis and hurricanes. **Task:** Students must develop an IoT-based early warning system using sensors to monitor environmental parameters, a communication network to transmit data, and a central system to analyze the data and issue alerts.

• Implementation of wearable sensor technology. • Integration of data analytics for early complication detection.	Integrate sensors into IoT applications and data acquisition techniques.	**Use Case 9: Smart Shirt for Health Monitoring** **Scenario:** A healthcare provider wants to offer remote health monitoring for patients with chronic conditions. **Task:** Students must design a smart shirt embedded with sensors to monitor vital signs such as heart rate, respiration, and temperature, and transmit the data to a healthcare provider for real-time analysis.
• Development of real-time alert systems. • Adherence to home automation for security purposes.	Integrate IoT platforms and frameworks for managing and orchestrating IoT devices.	**Use Case 10: Home Security Systems** **Scenario:** Homeowners want to upgrade their security systems with advanced IoT technologies. **Task:** Students must develop a comprehensive smart home security system using IoT devices such as smart locks, cameras, motion sensors, and an integrated platform to monitor and control the security devices remotely.

• Effectively integrate sensors into IoT applications for data collection and processing. • Development of intelligent transportation systems. • Adherence to vehicle-to-vehicle communication protocols.	Integrate sensors into IoT applications and data acquisition techniques.	**Use Case 11: Connected Vehicles** **Scenario:** An automobile manufacturer aims to enhance vehicle connectivity and safety features. **Task:** Students must design a connected vehicle system using IoT to monitor vehicle parameters, provide real-time traffic updates, and enhance safety through features like collision detection and automated emergency responses.
• Utilization of data analytics for demand forecasting. • Application of sustainability practices in waste management.	Implement key IoT concepts, architectures, and components.	**Use Case 12: Waste Management System** **Scenario:** A city seeks an efficient waste management system to optimize collection routes and reduce operational costs. **Task:** Students must develop an IoT-based waste management system with smart bins that use sensors to monitor fill levels and communicate with a central system to optimize collection schedules.

• Development of adaptive control algorithms for traffic lights. • Application of real-time data analysis for optimization.	Evaluate connectivity technologies like Bluetooth, Zigbee, WiFi, etc. - Compare suitability based on range, power consumption, and data requirements. - Select appropriate connectivity technology for specific use cases.	**Use Case 13: Streetlight Control System** **Scenario**: The smart streetlight control system needs to ensure reliable communication between streetlights and the central management system. **Task**: Students must analyze various connectivity technologies (e.g., Zigbee, LoRaWAN, WiFi) and choose the most suitable one based on range, power consumption, and data requirements for the streetlight control system.

Course Duration: 60 Hours

Test Projects:

1. Street light Management
2. Fire Detection system
3. Smart shirt for Health monitoring
4. Waste Management system
5. Smart parking System
6. Air Quality Monitoring
7. Smart Home Automation
8. Agricultural Crop monitoring
9. Smart Energy Management
10. Traffic Management system
11. Disaster Early Warning System
12. Smart city Safety-Early Response
13. Wearable Technology
14. Industrial Automation
15. Connected Vehicles
16. Environmental Monitoring

17.Healthcare Monitoring
18.Fleet Management
19.Home Security Systems
20.Asset Tracking

Student Assessment Plan:

Each of the above-mentioned test projects will be divided into tasks by the training partner for each specific institution. Such tasks will be jointly evaluated by the faculty and the training partner and the following weightage is to be followed.

- 70% weightage to the external practical assessment.
- 30% weightage to the internal assessment.

Final Test Project/External Assessment Plan:

The Final Test Project will be chosen from the list given above, jointly by the college faculty and the Training Partner. The Final Test Project will be assessed on the following tasks, for 70 marks:

Task	Description	Marks
Task 1	Research the problem statement for the given project.	5 marks
Task 2	Analyse the technical requirements for the project.	10 marks
Task 3	Design the prototype based on the requirements and check for the technical compatibility.	15 marks
Task 4	Build/Code the project based on the previously developed design.	20 marks
Task 5	Test and demonstrate the output.	20 marks