Course Title: Fundamentals of IoT (Base Program)
Duration: 4 Weeks
Sessions: 3 per week × 3 hours each = 36 hours
Format: Balanced blend of theory, demos, and hands-on labs

Week 1: IoT Foundations and Device Programming

Session 1: Introduction to IoT Tools, Platforms, and Systems

- IoT fundamentals, components, use cases
- Overview of course tools (Raspberry Pi, Arduino, AWS, Firebase, MQTT, ThingSpeak)
- Industry trends and applications

Session 2: Getting Started with Raspberry Pi

- Setting up Raspberry Pi, GPIO basics, Python programming
- Connecting sensors (DHT11, soil moisture)
- Hands-on: Read sensor data and control actuators

Session 3: Arduino Programming & Sensor Integration

- Arduino Uno and ESP boards overview
- Interfacing sensors (temperature, light) and actuators (LED, motor)
- Hands-on: Sensor readout, basic automation logic

Week 2: IoT Communication and Cloud Integration (AWS + Firebase)

Session 4: IoT Networking with ESP + Raspberry Pi

- Adding Wi-Fi via ESP8266/ESP32
- HTTP & REST basics
- Hands-on: Send sensor data to local web server / endpoint

Session 5: AWS IoT Core Essentials

- Setting up AWS IoT account, policies, Things
- MQTT intro and AWS IoT Core device communication
- Hands-on: Publish sensor data to AWS using MQTT

Session 6: Firebase Integration for Real-Time IoT

- Firebase Realtime Database vs Firestore
- REST API & Firebase SDK overview
- Hands-on: Send data from Raspberry Pi/ESP to Firebase

- Real-time updates and monitoring

Week 3: MQTT and Data Visualization

Session 7: MQTT Protocol for Lightweight IoT Messaging

- MQTT: Broker, topic, pub/sub model
- Setting up Mosquitto broker
- Hands-on: Use MQTT for Raspberry Pi ↔ Arduino communication

Session 8: Secure MQTT and Real-world Use Cases

- MQTT over SSL/TLS
- Smart agriculture/home examples
- Hands-on: MQTT-based communication system with secure topics

Session 9: ThingSpeak for IoT Dashboards

- ThingSpeak setup, channel creation
- Data visualization and MATLAB analytics
- Hands-on: Send data to ThingSpeak and build live dashboards

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Week 4: Final Integration and Capstone Project

Session 10: End-to-End IoT System Integration

- Combine Raspberry Pi, Arduino, sensors, cloud, and visualization
- Use case selection (e.g., smart farming, weather station)
- Team/project grouping and design phase begins

Session 11: Project Development & Testing

- Build, troubleshoot, and optimize the full IoT pipeline
- Incorporate at least 3 platforms (e.g., AWS, MQTT, ThingSpeak)
- Final testing and refinements

Session 12: Final Project Demos and Evaluations

- Project presentations
- Peer reviews and instructor feedback
- Wrap-up and certificate eligibility evaluation

Key Deliverables :

- **Labs and Exercises** for each platform

- **Assignments** after each session
- **Final Project**: Functional IoT system
- **Certificate of Completion** for successful students

Tools & Platforms Required

- **Hardware**: Raspberry Pi, Arduino/ESP, sensors (DHT11, light, soil moisture), actuators

- **Software**: Arduino IDE, Raspberry Pi OS, Mosquitto MQTT, AWS IoT Console, Firebase, ThingSpeak