



# **IoT Programmer (IP) Course Syllabus**

## **Module (1/13)**

### **Module Name: Overview of IoT and High level Architecture**

- What Is the Internet of Things (IoT)?
- Brief History and evolution of IoT
- IoT Architecture and Protocols
- Various Platform of IoT
- Overview of IoT components and IoT Communication Technologies
- Trends in the Adoption of IoT
- IoT is Powerful and Pervasive
- Societal Benefits of IoT
- Risks, Privacy, and Security

## **Module (2/13)**

### **Module Name: Setting up IoT Workflow**

- Arduino Simulation Environment
- Arduino Uno Architecture
- Setup the IDE, Writing Arduino Software
- Arduino Libraries

## **Module (3/13)**

### **Module Name: Advanced C Programming**

- Basics of C:
- Operators
- Conditionals
- Arrays
- Functions
- Advanced C programming:
- Structures
- Unions
- Files
- Deep dive into pointers



- Pre-processor directives
- Recursion
- Data Structures

## **Module (4/13)**

### **Module Name: Embedded C Programming**

- Project environment - Creating & Building a project, Makefiles
- Deep dive - Logic to program translation, Creating your own library, Dry-run
- Basics of Embedded C programming for Arduino
- Interfacing LED, push button and buzzer with Arduino
- Interfacing Arduino with LCD

## **Module (5/13)**

### **Module Name: Micro-controller programming using Arduino platform**

- Overview of Embedded Systems
- Components of Embedded Systems
- Micro-controller Architecture and Properties
- Installing and Setting up the Arduino development environment
- Blinky Sketch – A walk through
- Arduino Sketches
- Classes
- Sketch Structure
- Pins
- Arduino Shields

## **Module (6/13)**

### **Module Name: Micro-controller programming using Arduino platform**

- Learn basic communication protocols
- Communicate using Arduino Libraries
- IoT sensors and Actuators
- Debug applications using Arduino IDE
- Hands-on working with GPIOs, Analog I/Os, Memory usage
- Micro controller peripherals usage - Timers, Counters, Interrupts and its sources
- Communication protocols I - UART, SPI, I2C, CAN
- Interfacing IoT sensors and Actuators
- Debug applications using Arduino IDE
- Communication protocols II – Wired and Wireless communication
- Ethernet Client Server Implementation



- Build WiFi Application
- Build Bluetooth Application

## **Module (7/13)**

### **Module Name: Arduino Platform Applications**

- Hands-on working with GPIOs, Analog I/Os, Memory usage
- Micro controller peripherals usage - Timers, Counters, Interrupts and its sources
- Communication protocols I - UART, SPI, I2C, CAN
- Interfacing IoT sensors and Actuators
- Debug applications using Arduino IDE
- Communication protocols II – Wired and Wireless communication
- Ethernet Client Server Implementation
- Build WiFi Application
- Build Bluetooth Application

## **Module (8/13)**

### **Module Name: Programming with Python**

- Overview of Programming with Python
- Native Datatypes and Operators
- Python Statements and Conditionals
- Functions
- Strings
- Object oriented programming with Python
- Errors and Exception Handling
- File handling
- Regular expression
- Modules and Packages

## **Module (9/13)**

### **Module Name: Raspberry Pi for IoT**

- Overview of Raspberry Pi (RPi) hardware platform
- Peripherals on Rpi
- Setup and Install Raspbian OS on Rpi
- Install packages on Raspbian OS
- Setting up Raspbian as an IoT gateway

## **Module (10/13)**

### **Module Name: Linux for Raspberry Pi**



- Overview of Linux OS and its sub-systems
- Process
- Memory Management
- Multi-Threading
- IPC
- Linux CLI and important commands
- Linux File System
- Everything is a file concept in Linux
- Device Access using system calls

## **Module (11/13)**

### **Module Name: IoT Applications with Raspberry Pi**

- Write Python program to interface with Arduino using serial libraries
- IoT Communication Models and Protocols
- Request-Response, Publish-Subscribe, Push-Pull, Exclusive Pair
- Application Protocols: HTTP, CoAP, MQTT, AMQP
- Communication APIs: REST-based, WebSocket-based
- Network Layer: IPv4, IPv6, 6LoWPAN
- Building python based programs to communicate to cloud server using various application protocols
- Develop a complete python based application IoT application
- Rpi as a device
- Interfacing with sensors and actuators using GPIO pins
- Interfacing with camera on Rpi

## **Module (12/13)**

### **Module Name: IoT Cloud Infrastructure**

- IoT cloud building blocks
- Using the platform specific dashboards
- Device configuration and addressing
- IoT Platforms in detail
- MQTT Server
- Injection Engine
- Time Series database
- Rules Engine
- Data monitoring, visualization and IoT Analytics
- Rest API interface
- Device Management
- Application Service

## **Module (13/13)**

### **Module Name: Performance and Security in IoT**

- Benchmarking IoT applications and Platforms
- MQTT vs HTTP performance
- Security considerations
- Firmware updates
- Cryptography basics
- Cryptography in IoT
- Privacy considerations and design guidelines

## **Module (14/14)**

### **Module Name: Project**

- Any module of project which is based on office/home automation
- Design device architecture for handling office/home automation module
- Device architecture design using with Arduino/UNO/Raspberry Pie board
- Device architecture design using with Sensors
- Device connected with sensors and board with bread board
- Cloud configuration and communicate with Arduino
- Customize device functionality with advanced C Programming
- Test Cases write in python
- Wireless and Bluetooth communication with Using Zigbee and BLE