



## 1. Introduction- Concepts and Technologies behind Internet of Things (IoT)

### Concepts & Definitions

Identification, localization, wireless protocols, data storage and security; Collecting, communicating, coordinating, and leveraging the data from connected devices; Understand how to develop and implement IoT technologies, solutions, and applications. Machine Learning, Distributed Computing, Artificial Intelligence

## 2. IoT Architecture

- IoT Network Architecture
- IoT Device Architecture
- IoT Application Architecture
- Client Server vs Publish Subscribe Architecture

## 3. IoT Device Design

**Sensors** – Classification & selection criteria based on nature, frequency and amplitude of signal

**Embedded Development Boards** – Arduino, Raspberry Pi, Intel Galileo, ESP8266,  
**Interfacing peripherals & Programming GPIOs** – Input/output peripherals, Sensor modules

**Design Considerations** – Cost, Performance & Power Consumption tradeoffs

## 4. IoT Communication Protocols

- **Wired Communication Protocols** – UART, USART
- **Wireless Communication Protocols** – Bluetooth, Zigbee, 6lowPAN, WiFi
- **Networking Protocols** – OSI Reference Model, TCP/IP, Ethernet
- **Application Protocols** – HTTP, Web sockets, MQTT, CoAP

## 5. Programming Languages

- Assembly
- C/C++
- Python –
- Micropython
- LUA



## 6. Cloud Computing

- Concept & Architecture of Cloud
- Role of Cloud Computing in IoT
- Tools, API and Platform for integration of IoT devices with Cloud

### HANDS ON SESSIONS:

- Interfacing sensor (Analog & Digital) with MCUs
- Interfacing switches and LEDs with MCUs
- Developing advance user interfaces (virtual reality) for intelligent IoT devices
- Interfacing sensors and other peripherals using SPI and I2C communication protocols
- Installation of Python, Vpython
- Learning python fundamentals and programming
- Installation & usage of Numpy python package
- Working with arrays using Numpy package
- Working with 2D/3D graphics using Vpython package
- Running python on Raspberry Pi, GPIO programming
- Setting up wireless (bluetooth) link between systems
- Configuring bluetooth module by using AT commands
- Configuring and uploading data on cloud using WiFi ESP8266 module using AT commands
- Programming ESP8266 module using LUA and Micropython to access/upload data on cloud
  
- Setting up HTTP server and testing HTTP methods on local host and with cloud
- Setting up MQTT server and testing publish & subscribe methods
- Understanding TCP/IP protocol and pushing and pulling data from cloud using Get/Post methods
- Understanding differences between TCP and UDP protocols practically

### BASIC IOT LAB SETUP

#### 1. Development Boards

- Raspberry Pi 3
- Arduino Mega (ATMega2560)
- Memory Card (16 GB)
- HDMI – VGA Converter
- 1A Power Adapter



## 2. **Electronic Components**

- Sensors – Analog temperature sensor(LM35)
- IR Proximity Sensor
- Switches – Push Button (10)
- Breadboard
- Alphanumeric LCD(16×2)
- DC Motor
- LEDs (10)
- Resistors (20)
- Connecting leads (25)

## 3. **Communication Modules**

- WiFi – ESP12E (breakout Board)
- Bluetooth – HC05