**IT\_4050: INTERNET OF THINGS [3 0 0 3]**

**Objectives:**

• To understand the principles of internetworking of embedded devices.

• To learn the state-of-art architectures for IoT.

• To understand various technologies and protocols aimed at enabling the formation of highly distributed and ubiquitous networks of seamlessly connected heterogeneous devices which can be fully integrated into the current Internet.

• To analyze and visualize sensor data

**Abstract:**

Introduction to M2M communication and IoT , An emerging industrial structure for IoT, IoT system architecture, IoT reference model, IoT deployment and operational view, IoT physical devices and endpoints, Communication and networking protocols-MQTT and AMQP protocols, IoT enabling technologies-RFID, WSN,SCADA etc., Analytics for the IoT, Applying the geospatial analytics to IoT data, Real world design constraint, Technical design constraint, Future internet design for various IoT use cases such as smart cities, smart environments, smart homes, smart health etc.

**Syllabus:**

**Introduction:**

M2M Communication, IoT, M2M value chain, IoT value chain, an emerging industrial structure for IoT, Implications for IoT, Barriers and concern, IoT use case example. [3 Hours]

**M2M to IoT – An Architectural Overview:**

An IoT architecture outline, Standards considerations. IoT data Management, IoT architecture-State of art solution, IoT reference model, IoT deployment and operational view. [7 Hours]

**IoT Physical devices and endpoints:**

Basic building blocks of an IoT Device, Exemplary Device: Raspberry Pi, interfaces, Programming Raspberry Pi with Python. IoT physical servers and cloud offerings: introduction to cloud storage models and communication Networks, REST APIs along with HTTP, MQTT and AMQP protocols [6 Hours]

**IoT Enabling Technologies:**

M2M: The Internet of Devices, RFID: The Internet of Objects, WSN: The Internet of Transducers, SCADA: The Internet of Controllers. Web of Things versus Internet of Things, M2M and WSN Protocols, SCADA and RFID Protocols, Issues with IoT Standardization, Unified Data Standards [10 Hours]

**Analytics for the IoT:**

Data flows from the IoT device to the final data set, Develop techniques to wring value from IoT data, apply geospatial analytics to IoT data, Use machine learning as a predictive method on IoT data. [6 Hours]

**Real-world Design Constraint:**

Technical design constraints, IoT devices and networks, data representation and visualization, interaction and remote control. [2 Hours]

**IoT Use Cases:**

Ubiquitous IoT Applications, Telematics and Intelligent Transport Systems, Smart Grid and Electric Vehicles, Smarter Planet and Smart Buildings, Home Healthcare and Remote Patient Monitoring. [2 Hours]

**Outcomes:**

Upon completion of the course, the students will be able to:

• Demonstrate an internetwork between embedded devices through the Internet

• Apply the concept of IoT for a particular sensor based network

• Choose appropriate network architecture for a particular application.

• Analyse and design networks to support the development of intelligent services with given performance requirements in a variety of application domains.

• Assess different Internet of Things technologies and their applications.

**References:**

1. Holler J., Tsiatsis V., Mulligan C., Karnouskos S., Boyle D., From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence (1e), Elsevier 2014.

2. Bahga A., Madisetti V., Internet of Things-A Hands on Approach (1e), Orient Blackswan Private Limited, 2015.

3. Roderick O., Marko N., Sanchez D. and Aryasomajula A., Internet of Things and Data Analytics Handbook (1e), Wiley-Blackwell, 2017.

4. Patil Y., Azure IoT Development Cookbook (1e), Packt publishing Ltd, 2017.

5. Minteer A., Analytics for the Internet of Things (1e), Packt publishing Ltd, 2017.