



Solapur University, Solapur
B.E. (Electronics & Telecommunication) Semester-II
Internet of Things

Teaching Scheme

Lectures – 4 Hours/week, 4 Credits

Practical – 2 Hours/week, 1 Credit

Examination Scheme

ESE - 70 Marks

ISE - 30 Marks

ICA - 25 Marks

The Internet of Things (IoT) refers to the system in which different devices equipped with sensors and signal processing are connected through a network to communicate with each other and/or with central servers. This course provides a thorough introduction to the different components of an IoT System. The course also introduces cloud platforms of IoT and different communication protocols. Introduction to Cortex M Series ARM architecture is also a part of this course.

Course Prerequisite:

Student has completed a course in microcontroller and interfacing and has an adept knowledge of assembly and C language programming. Student also has knowledge of interfacing techniques and working of different peripherals

Course Objectives:

1. To make student aware of different components of an IoT System
 2. To make student learn the architecture of Cortex M3 series ARM microcontroller.
 3. To make student learn interfacing of different peripherals with microcontroller.
 4. To make student learn different communication technologies and application protocols used in IoT.
 5. To introduce to student different cloud platforms of IoT.
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Course Outcomes:

1. Student can elaborate different components of an IoT System.
 2. Student can describe the architecture Cortex M3 series ARM microcontroller
 3. Student can write interfacing program for different applications with ARM microcontroller.
 4. Student can describe different communication technologies and application protocols used in IoT.
 5. Student can elaborate different cloud platforms of IoT.
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Section I

Unit 1 - Introduction to Internet of Things

No of lectures – 05

Introduction to IoT, different components of an IoT system: embedded systems, sensors, communication systems, cloud, applications of IoT in various domains.

Unit 2 – Embedded Systems for IoT

No of lectures – 09

Introduction to embedded systems, different components of an embedded system, and basics of microcontroller based embedded systems; basics of Linux based embedded systems, role of embedded systems in IoT, understanding the various IDEs used for embedded development.

Unit 3 – Introduction to ARM

No of lectures – 12

Introduction to ARM architecture, cortex series classification (A, R, M series), ARM Cortex-M series family, ARM Cortex-M3 processor overview, block diagram, registers, memory map, instruction set: data accessing, processing, arithmetic, program flow control etc., exception handling, low-power features, requirements, sleep mode, development of low-power applications, basic embedded C programs for on-chip peripherals, interfacing I/O devices like led's, switch's etc., serial communication, analog interfacing and data acquisition, concepts of application programming interface (API).

Section II

Unit 4 – Communication technologies for IoT

No of lectures – 10

Basics of the communication technologies like Bluetooth Low Energy (BLE), Zigbee, Wifi, RFID, their architecture, characteristics, limitation, power consumption parameters and applications

Unit 5 - Application protocols for IoT

No of lectures – 09

Basics of application protocols like MQTT and CoAP, their features, framework, message formats, implementations and applications

Unit 6 - Cloud platforms for IoT

No of lectures – 07

Cloud architecture for IoT, concept of APIs, survey of various IoT cloud platforms, understanding the costing structure of cloud for IoT services, performance metrics for cloud platforms in IoT

• Internal Continuous Assessment :

ICA consists of minimum 8 to10 practicals based on following with Cortex M3 microcontroller

1. Interfacing general purpose I/O devices like LED's, switches
2. Interfacing motors
3. Reading sensor values and plotting them on the PC through UART
4. Interfacing BLE/Wifi modules with ARM based platforms
5. Interfacing sensor and sending data to the cloud using Wifi
6. Interfacing sensor and sending data to smart devices using BLE.
7. Implement an interrupt handler to illustrate low power feature
8. Implement Bluetooth Low Energy connection between the microcontroller kit and smart devices.

- **Text Books**

1. Internet of Things by Raj Kamal
 2. The Definitive Guide to the ARM Cortex-M3 by Joseph Yiu
 3. Internet of Things for Architects by Perry Lea
 4. Analytics for the Internet of Things (IoT) by Andrew Minter
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- **Reference Books**

1. Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies by Dimitrios Serpanos, Marilyn Wolf
 2. MQTT Essentials - A Lightweight IoT Protocol by Gaston C. Hillar
 3. Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3 by Peter Waher.
 4. Designing Embedded Systems and the Internet of Things (IoT) with the ARM mbed by Perry Xiao
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- **Recommended Online Free Courseware**

1. Udemy.com
2. Introduction to ARM mbed : playlist on Youtube

