PRE-REQUISITES:

Micro-Processors and Micro-Controllers, Control Systems, Logic Design.

1. Frank Vahid, Tony Givargis, "Embedded System Design: A Unified Hardware / Software Approach", *John Wiley and Sons*.
2. Kai Hwang, "Advanced Computer Architecture", *Tata McGraw Hill*, India.
3. Raj Kamal, "Embedded Systems – Architecture, Programming and Design", *Tata McGraw Hill*.
4. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A Hands on Approach", 1st Edition, 2015.
5. Sridipta Misra, Muthucumaru Maheswaran, Salman Hashmi, "Security Challenges and Approaches in Internet of Things" Springer Briefs in Electrical and Computer Engineering, 2017, ISBN 978-3-319-44229-7.
6. Shancang Li Li Da Xu, "Securing the Internet of Things", 1st edition, ISBN: 978012804505
7. Brian Russell, Drew Van Duren, "Practical Internet of Things Security", *Kindle Edition*.

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MODULE 5

IoT Platforms Design Methodology: Introduction, IoT Design Methodology-Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification. Functional View Specification, Operational View Specification, Device & Component Integration, Application Development. IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python –Controlling LED with Raspberry Pi.

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MODULE 4

- Definition and Characteristics of IoT, Physical Design of IoT- Things in IoT, IoT Protocols, Logical Design of IoT- IoT Functional Blocks, IoT Communication Models, IoT Communication APIs

- **IoT and M2M:** Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT- Software Defined Networking, Network Function Virtualization.

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MODULE 3

- **Communication Protocols:** Serial Protocols: I2C, CAN and USB Parallel Protocols: PCI bus, (Text Book 1, 2).

- **Real Time Operating Systems:** Real Time and Embedded Operating Systems, Schedule Management for Multiple Tasks by an RTOS, Interrupt Routines in RTOS Environment, RTOS Task Scheduling models (Text Book 2, 3).

MODULE 2

- **Memory Hierarchy, Bus and Cache:** Memory Hierarchy Technology, Virtual Memory Technology, Cache Memory Organizations (Text Book 3).

- **Interfacing, Peripherals and Interfacing:** General Purpose Microprocessors, Timers, Watchdog Timers, PWM, LCD, UART, Keypad Controller, Stepper Motor Controller, ADC

MODULE 1

- **Introduction:** Embedded System Overview, Design Challenges – Optimizing design metrics, Embedded Processor Technology: (Text Book-1).

- **Processors Architecture:** Advanced Processor Technology, Super Scalar and Vector Processors (Text Book 2).

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COURSE OBJECTIVES:

1. To familiarize the basic design concepts of Embedded System Design and to introduce different processor architecture and working principles
2. To understand the memory concepts in detail and understand various embedded peripherals, communication protocols employed
3. Dealing with High level operating systems
4. To introduce emerging technological options, platforms and functions of Internet of Things (IoT).
5. To understand the technical aspects of IoT and machine-to-machine and to learn the platform designing methodology.
- To have the various platform design for IoT