EMBEDDED SYSTEM DESIGN AND IOT Applications

Course Code : 18EC6DCEAI
L : P : T : S : 4 : 0 : 0 : 0
Exam Hours : 03
Total Hours : 50

Credits : 04
CIE Marks : 50
SEE Marks : 50
CIE + SEE : 100

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.
6. To have the various platform design for IoT.

COURSE OUTCOMES:

After completion of the course, the graduates will be able to

CO1	To know the basic architecture of embedded system design and analyse different processor architecture..
CO2	To understand the working principles of different peripherals, memory subsystems and communication protocols.
CO3	To describe memory constraints and compatibility between peripherals and processors. To illustrate RTOS application
CO4	Understand the concepts of IoT, Architecture and different Reference Models , various Applications of IoT and Management Challenges in the Internet of Things
CO5	Understand IoT Hardware Development Platforms Past, Present, and Future.
CO6	Develop IoT applications to solve social problems.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	-	-	-	-	-	-	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-
CO3	3	2	3	3	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	1	-	-	-	-	-	-	-	-
CO6	3	2	2	2	-	-	-	-	-	-	-	-

Module	Contents of the Module	Hours	CO's
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).	8	CO1
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	8	CO2 CO3
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).	8	CO2 CO3 CO4
4	**Introduction to the Internet of Things:** Introduction, Definition of IoT, Proposed Architectures and Reference Models, Enabling Technologies, Application Areas: An Overview, Challenges. (Text Book 4).	7	CO5 CO1

	Organizational Implementation and Management Challenges in the Internet of Things: Introduction, IoT in Organizations, Managing IoT Systems. (Text Book 4).		
5	**IoT Hardware Development Platforms Past, Present, and Future:** Introduction, IoT Hardware Development Platforms, IoT Hardware Development Platforms in the Past 9 Years, Current IoT Hardware Development Platforms, IoT Hardware Development Platforms in the Next 5 Years, Timeline of Evolution of the IoT Hardware Development Platforms. (Text Book 4).	9	CO5 CO6

NOTE:

1. Questions for CIE and SEE not to be set from self-study component.
2. Assignment Questions should be from self-study component only.

PRE-REQUISITES:

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

SELF-STUDY COMPONENT:

Unit-1 : Understanding general Purpose and ASIC design, Data path, RT Level Sequential components, optimizing FSMD.
Unit-2 : VLIW architecture, Scalable Architectures, 32 bit processors.
Unit-3 : Problem solving capability in Cache Memory Implementation, understanding PCI – XPRESS.
Unit-4 : Building the Blocks into the IoT,

TEXT BOOKS:

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 Hil*l.
4. Hassan, Q.F., Atta ur, R.K., & Madani, S.A. (2017). "Internet of Things: Challenges, Advances, and Applications" (1st ed.). CRC Press. https://doi.org/10.1201/9781315155005

REFERENCE BOOKS:

1. James K. Peckol, "Embedded Systems – A Contemporary Design Tool", *John Wiley India Pvt. Ltd*., 2008.
2. Shibu K.V., "Introduction to Embedded Systems", *Tata McGraw Hill Education*, India.
3. Tammy Noergaard, "Embedded Systems Architecture – A Comprehensive Guide for Engineers and Programmers," *Elsevier Publication*, 2005
4. Dreamtech Software Team, "Programming for Embedded Systems", *John Wiley India* Pvt. Ltd, 2008.
5. Ovidiu Vermesan and Peter Friess, "The River Publisher Series in Communications, Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems", *Edition* - 2013.
6. Massimo Banzi, "Getting Started with Arduino (Make: Projects)", *O'Reilly Media*, 2008.
7. Mike Kuniavsky, "Smart Things: Ubiquitous Computing User Experience Design", *Morgan Kaufmann Publishers*, 2010.
8. Sara Cordoba, Wimer Hazenberg, Menno Huisman, "Meta Products: Building the Internet of Things", *BIS Publishers*, 2011.
9. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A Hands on Approach", 1st Edition, 2015.

MOOCS :

https://onlinecourses.nptel.ac.in/noc18_cs46/preview

https://www.coursera.org/learn/iot