# 19CS41E2 - EMBEDDED SYSTEMS

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| **Course Category:** | Professional Elective | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture – Tutorial – Practical:** | 3-0-0 |
| **Prerequisite:** | Require Embedded system basics and fundamentals of embedded system features. | **Sessional Evaluation:****Univ. Exam Evaluation:****Total Marks:** | 4060100 |
| **Objectives** | * To introduce the Building Blocks of Embedded System
* To have knowledge about the basic working of a microcontroller system and its programming in assembly language.
* To provide experience to integrate hardware and software for microcontroller applications systems.
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| **Course Outcomes** | Upon the successful completion of the course, the students will be able to: |
| CO1 | Know the importance of embedded computing, design process. |
| CO2 | Learn about the basics and architecture of 8051 microcontroller and interrupts and assembly language programming. |
| CO3 | Study the various logical and arithmetic operations in assembly language. |
| CO4 | Know the basics of Real time operating system. |
| CO5 | Learn the design of real time operating system basics. |
| CO6 | Study various debugging techniques. |
| **Course Content** | **UNIT-I****Embedded Computing**: Introduction, Complex Systems and Microprocessor, The Embedded  System Design Process, Formalisms for System Design, Design Examples.**UNIT-II****The 8051 Architecture**: Introduction, 8051 Micro controller Hardware, Input/output Ports and Circuits, External Memory, Serial data Input/output, Interrupts. **Basic Assembly Language Programming Concepts**: The Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051. **UNIT-III**Data Transfer and Logical Instructions, Arithmetic Operations, Decimal Arithmetic, Jump and Call Instructions.**Applications**: Interfacing with Keyboards, Displays,D/A and A/D Conversions, Multiple Interrupts, Serial Data Communication.**UNIT-IV****Introduction to Real–Time Operating Systems**: Tasks and Task States, Tasks and Data, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Events, Memory Management, Interrupt Routines in an RTOS Environment.**UNIT-V****Basic Design Using a Real-Time Operating System**: Principles, Semaphores and Queues, Hard Real -Time Scheduling Considerations, Saving Memory and Power, An example RTOS like µC OS (Open Source).**UNIT-VI****Embedded Software Development Tools**: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System.**Debugging Techniques**: Testing on Host Machine, Using Laboratory Tools, An Example System |
| **Text Books and References** | **TEXT BOOKS:**1. Computers as Components-principles of embedded computer system design, Wayne Wolf, Elsevier.
2. The 8051 Microcontroller, Third Edition, Kenneth J. Ayala, Thomson.
3. An Embedded Software Primer, David E. Simon, Pearson Education.

**REFERENCE BOOKS:**1. Embedding system building blocks, Labrosse, via CMP publishers.
2. Embedded Systems, Raj Kamal, TMH.
3. Micro Controllers, Ajay V Deshmukhi, TMH.
4. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley.
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| **E-Resources** | 1. <https://nptel.ac.in/courses>
2. <https://freevideolectures.com/university/iitm>
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