**4/4  B.Tech.  FIRST SEMESTER**

**IT7T4A**                         **EMBEDDED SYSTEMS**                         **Credits: 4**
**(Common to CSE/IT/ECM)**

**Lecture: 4 periods/week**                         **Internal assessment: 30 marks**
**Tutorial: 1 period /week**                         **Semester end examination: 70 marks**
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**Objectives :**

- To equip the students with the basic concepts of Embedded system(ES) and applications of ES
- To introduce 8051 microcontroller programming concepts  and various aspects of embedded system design from Hardware and Software points of view
- To demonstrate tools and methodologies needed for embedded system design.
- To explain RTOS concepts for coding the embedded system software routines and characteristics of latency in real-time systems.

**Outcomes :**

Students will be able to:

- Differentiate between microprocessor and microcontroller
- Understand the basics of an Embedded system(ES)
- Develop  8051 microcontroller programming
- Understand the concepts of RTOS
- Design and implement simple embedded systems in real time applications.

**Syllabus:**

**UNIT I**

**Embedded Systems Basics:** Introduction to Embedded systems, Examples of embeddedsystems,                         TypicalHardware,Gates, TimingDiagrams,Memory,Microprocessors,Buses,DirectMemoryAccess,         Interrupts, Microprocessor Architecture, Interrupt Basics.

**UNIT II**
**The 8051 Architecture** : Introduction, 8051 Micro controller Hardware, Input/output Pin Ports and Circuits, External Memory, Serial data Input/output, Interrupts.

**UNIT III**
Basic Assembly Language Programming Concepts: The Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051.

## UNIT IV

**Moving Data:** Introduction, Addressing Modes, External Data Moves, Code Memory Read-Only Data Moves, Push and Pop Opcodes, Data Exchanges.

## UNIT-V

**Applications:** Introduction, keyboards, Human Factor, Key Switch Factors, Keyboard Configurations, Displays, Seven-Segment Numeric Display, D/A and A/D Conversions.

## UNIT VI

**Introduction to Real – Time Operating Systems:** Survey of software Architectures: Round Robin, Round Robin with Interrupts, Function Queue Scheduling Architecture, Real Time Operating System Architecture, Selecting an Architecture, Tasks and Task States, Tasks and Data, Semaphores, and Shared Data.

## UNIT VII

**Basic Design Using a Real-Time Operating System**: Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment, Principles, Semaphores and Queues, Hard Real-Time Scheduling Considerations, Saving Memory and Power, An example RTOS like uC-OS (Open Source).

## UNIT VIII

**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:**
1. An Embedded Software Primer, David E. Simon, Pearson Education.
2. The 8051 Microcontroller, Third Edition, Kenneth J.Ayala, Thomson.

**Reference Books:**
1. 8051 Microcontrollers, Satish Shah, Oxford Higher Education.
2. Embedded Microcomputer Systems Real Time Interfacing, Jonathan W.Valvano, Cengage Learning.
3. Micro Controllers, Ajay V Deshmukhi, TMH.
4. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley.
5. Microcontrollers, Raj kamal, Pearson Education.