EMBEDDED SYSTEMS

Course Code: 13EE2203 **L P C**

4 0 3

Pre requisites: Basic Knowledge of Microcontrollers.

Course Educational Objectives: To provide the student with in-depth knowledge of embedded systems including overall system design, interfacing, operating systems, data acquisition, communication protocols, and real-time performance.

Course Outcomes:

At the end of the course, the student will be able to

1) Describe the design aspects of Embedded Systems.
2) Describe the fundamentals of 8051 architecture.
3) Explain the working of Real Time Operating Systems.
4) Analyze the design process of Real time Operating systems.
5) Describe the advanced architectures of ARM and SHARC processors

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, Counter and Timers, Serial data Input/Output, Interrupts. The Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051. Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions, Further Details on Interrupts. Interfacing with Keyboards, Displays, D/A and A/D Conversions, Multiple Interrupts, Serial Data Communication.

UNIT-III

INTRODUCTION TO REAL – TIME OPERATING SYSTEMS:

Tasks and Task states, Tasks and Data, Semaphores and Shared Data, Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment.

UNIT-IV

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 UC-OS (Open Source); 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.

UNIT-V

INTRODUCTION TO ADVANCED ARCHITECTURES

ARM and SHARC Processor and memory organization and Instruction level parallelism; Networked embedded systems: Bus protocols, I2C bus and CAN bus; Internet-Enabled Systems, Design Example-Elevator Controller.

Text books:

1. Wayne Wolf, "*Computers as Components*", Morgan Kaufman, 2010.
2. B.Kanta Rao, "*Embedded Systems*", PHI, First Edition, 2011
3. David E. Simon, "*An Embedded Software Primer*", Pearson Education, 2011.

Reference Books:

1. Jean. J. Labrosse,"*Embedded System building blocks*", 2nd edition, CMP publishers,1999.
2. Raj Kamal,"*Embedded Systems: Architecture, Programming and Design*", 2nd Edition, TMH, 2008.
3. Kenneth J. Ayala, "*The 8051 Microcontroller"*, Third Edition, Cenage Learning, 2010.
4. Frank Vahid, Tony Givargis, "*Embedded System Design*", JohnWiley, 2011.