4/4 B.Tech - SEVENTH SEMESTER

EC7T4A **Embedded and Real Time Systems** **Credits: 4**

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

Course Objectives:

- To understand the concepts of Embedded Systems, Real Time and embedded real time systems.
- To study single purpose processor, general purpose processor and application specific instruction set (ASIC) processor technologies and IC technology in detail.
- To understand the principles and concepts of embedded real time operating systems in detail.
- To understand the challenges in the design of various processors technology and to study the various process models and the various synthesis technologies required in detail.
- To study the various communication interfaces starting from simple hardware interface RS232 leading to complex software interface Bluetooth and their IEEE standards.

UNIT- I

Introduction: Embedded systems overview, design challenge, processor technology, IC technology, Design Technology, Trade-offs. Single purpose processors RT-level combinational logic, sequential logic (RT level), custom single purpose processor design (RT-level), optimizing custom single purpose processors.

UNIT- II

General Purpose Processors: Basic architecture, operation, Pipelining, Programmer's view, development environment, Application Specific Instruction-Set Processors (ASIPs) – Micro Controllers and Digital Signal Processors.

UNIT- III

State Machine And Concurrent Process Models: Introduction, models Vs. languages, finite state machines with data path model (FSMD), using state machines, program state machine model (PSM), concurrent process model, concurrent processes, communication among processes, synchronization among processes, implementation, data flow model, real-time systems.

UNIT- IV

Communication Interface: Need for communication interfaces, RS232 / UART, RS422 / RS485, USB, Infrared, IEEE 1394 Firewire, Ethernet, IEEE 802.11, Blue tooth.

UNIT- V

Embedded / RTOS Concepts – I: Architecture of the Kernel, Tasks and Task scheduler, Interrupt service routines, Semaphores, Mutex.

UNIT- VI

Embedded/RTOS Concepts – II: Mailboxes, Message Queues, Event Registers, Pipes, Signals.

UNIT- VII

Embedded / RTOS Concepts – III: Timers, Memory Management, Priority inversion problem, Embedded operating systems Embedded Linux, Real-time operating systems, RT Linux, Handheld operating systems, Windows CE.

UNIT- VIII:

Design Technology: Introduction, Automation, Synthesis, Parallel evolution of compilation and synthesis, Logic Synthesis, RT synthesis, Behavioural Synthesis, Systems Synthesis and Hardware/ Software Co-Design, Verification, Hardware/Software co-simulation, Reuse of intellectual property codes.

Learning Resources

Text Books:

1. Embedded System Design – A Unified Hardware/Software Introduction - Frank Vahid, Tony D. Givargis, John Wiley, 2002.
2. Embedded / Real Time Systems – KVKK Prasad, Dreamtech Press, 2005.

References:

1. Embedded Microcomputer Systems – Jonathan W. Valvano, Brooks / Cole, Thompson Learning.
2. An Embedded Software Primer – David E. Simon, Pearson Ed., 2005.
3. Introduction to Embedded Systems – Raj Kamal, TMS, 2002.
4. Embedded Real Time Systems Programming – Sri Ram V Iyer, Pankaj Gupta, TMH, 2004.