

Embedded Systems and Real-Time Programming

B.E. Sem. VIII [ETRX]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical & Oral	–	–
Oral Exam	–	25
Term Work	–	25

SYLLABUS

1. Introduction to Embedded Systems

Design Metrics, Examples of embedded systems, hardware/software co-design, Embedded micro controller cores (ARM, RISC, CISC, and SOC), embedded memories, sensors and interfacing techniques, Architecture of Embedded Systems.

2. Introduction to MSP 430 RISC Controllers, parallel I/O, external interrupts.

Introduction to ARM 7 instruction set, addressing modes, operating modes with ARM core, ARM7 TDMI modes, ADC, Timers, Interrupt structure.

Byte ordering (LE, BE), Thumb mode normal mode instructions changes, Pipeline utilization with all register allocations, Floating to fixed point conversion fundamentals.

System design with ARM as key processor.

DSP features of ARM Core

Digital Signal Controllers

- DSC differences with conventional micro controllers

3. Serial communications

SCI, SPI, Timing generation and measurements. Analog interfacing and data acquisition.

Hardware Interrupts :

- Various C ISR Declaration syntaxes
- Interrupt Vectors, Priorities and Nesting
- Tick Timer Interrupt as heart-beat of embedded system 7-Seg LED, Segment-LCD, Alphanumeric LCD, Graphic LCD displays Communications and Networks
- RS485 (2 and 3 wire) and Modbus Protocol (Intro only)
- Ethernet and TCP/IP Stack (Features and Usage only)
- CAN features and protocol

4. Software Programming in Assembly Language (ALP) and in High Level Language 'C', 'C' Program Elements: Header and Source Files and Preprocessor Directives, Program Elements: Macros and Functions, Program Elements: Data Types, Data Structures, Modifiers, Statements, Loops and Pointers, Queues, Stacks, Lists and Ordered Lists, Embedded Programming in C++, 'C' Program Compiler and Cross-Compiler, Source Code Engineering Tools for Embedded C/C++, Optimization of Memory Needs.

5. Real-time concepts, real-time operating systems, Required RTOS services/capabilities (in contrast with traditional OS). Real-world issues: blocking, unpredictability, interrupts, caching Benefits of using RTOS

- Concepts of Tasks/Threads/Process
- Multitasking
- Task Scheduling

- Task management
- Inter-task communication and Synchronization:
- Device Drivers
- How to choose an RTOS

6. Fundamentals of Design and Development, Program Modelling tools Testing and Debugging methodologies.

Applications of Embedded Systems : case studies

- Consumer and Home
- Industrial and Automation
- Medical
- Robotics
- Access Control Systems (Smart Cards, RFIDs, FingerScan)

Reference Books :

1. Embedded Systems - Architecture, Programming and Design (*Rajkamal*) Tata McGraw Hill, Second edition, 2009
2. Introduction to Embedded Systems (*Shibu K V*) Tata Mc Graw Hill, 2009
3. Embedded Realtime Systems Programming (*Sriram Iyer and Pankaj Gupta*) Tata McGraw Hill, first edition, 2003
5. Embedded Microcomputer Systems (*Jonathan W. Valvano*) Thomson
6. An Embedded Software Primer (*David E. Simon*) Pearson Education
7. Embedded real time system (*Dr. K.V.K.Prasad*) Dreamtech Press.

