M.Sc. Computer Science Syllabus Second Year (2019-24) (Sem - IV)
Embedded Systems
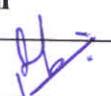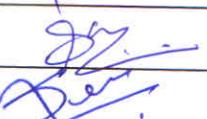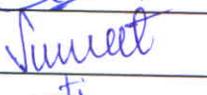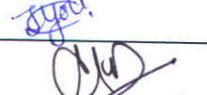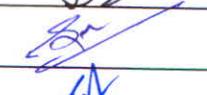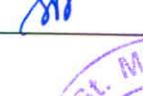
Semester IV	Subject Code: MSE41903	Lectures: 60

Objectives:

The syllabus aims in equipping students with,
- design embedded systems and real-time systems
- understanding real-time systems:
- Apply real-time systems design techniques to various software programs.
- understanding embedded systems, it will enable you to :
    - Understand the basics of an embedded system
    - Program an embedded system
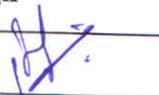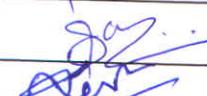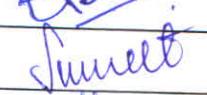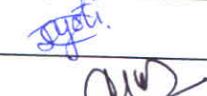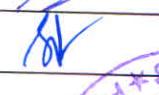
| Unit 1: Introduction to ES	08
Chapter 1 : Introduction to ES • What is ES • Examples of ES • Inside ES : processor, memory, peripherals, software	02
Chapter 2 : Embedded Processors , Memories & Peripherals • Microcontrollers 8051 • Discrete processors : 8-bit architecture, 16/32 bit CISC, RISC, DSP • Integrated processors : ARM RISC • Choosing a processor • Memory systems : types (SRAM, DRAM, FLASH), organization, access time, validating the contents of memory • Basic peripherals : parallel ports, timers, clocks	06

Sr. No.	BOS member		Sign
1	Dr. Razak Sayyed	Subject Expert	
2	Prof. Abhijit Sathe	Subject Expert	
3	Prof. Sonali Deshmukh	Subject Expert	
4	Mr. Sumeet Kakroo	Industry Expert	
5	Ms. Jyoti Sharma	Alumni	
6	Prof. Ashwini Kulkarni	Chairman	
7	Prof. Swati Pulate	Internal Faculty	
8	Prof. Smita Borkar	Internal Faculty	

Unit 2: Software for embedded systems	20

Chapter 3 : Real time system concepts — 12

- Foreground/ background systems
- Critical section of code
- Resourse, shared resourse
- Multitasking, task, task switch
- Kernel, scheduler, non-preemptive kernel, preemptive kernel
- Reentrancy, round-robin scheduling
- Task priority, static priority, dynamic priority, priority inversions, assigning task priorities
- Mutual exclusion, deadlock, synchronization, event flags, intertask communication
- Interrupts : latency, response, recovery, ISR processing time, NMI

(For 'C' implementation of above concepts, please refer to chapters 4,5,6,7 of the book "An Embedded Software Primer" by David E. Simon published by Pearson Educations)

Chapter 4 : Writing software for embedded systems — 8

- The compilation process : compile, link, load
- Cross compilers
- Run-time-libraries : processor dependent, I/O dependent, system calls,exit routines
- Writing a library, using alternative libraries
- Porting Kernels
- C extensions for embedded systems
- Buffering and other data structures
      Linear buffers, Directional buffers, Double buffering, Buffer exchange, Linked lists, FIFO, Circular buffers, Buffer underrun and overrun, Allocating buffer memory, Buffer leakage
- Downloading

Sr. No.	BOS member		Sign
1	Dr. Razak Sayyed	Subject Expert	
2	Prof. Abhijit Sathe	Subject Expert	
3	Prof. Sonali Deshmukh	Subject Expert	
4	Mr. Sumeet Kakroo	Industry Expert	
5	Ms. Jyoti Sharma	Alumni	
6	Prof. Ashwini Kulkarni	Chairman	
7	Prof. Swati Pulate	Internal Faculty	
8	Prof. Smita Borkar	Internal Faculty	

Unit 3: Basic design using RTOS	20

|	

Chapter 5 : Emulation and Debugging techniques
 	
    • Debugging techniques :
        ▪ HLL simulation, low level simulation, on-board debugger, task level debugging, symbolic debug
    • Emulation
    • Optimization problems
	6
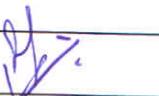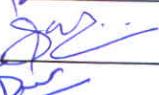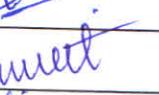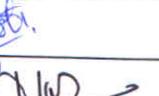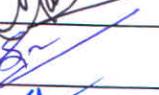
Chapter 6 : Basic design using RTOS
    • Overview
    • Principles
    • Example
    • Encapsulating semaphores and queues
    • Hard real time scheduling considerations
    • Saving memory space
    • Saving power
	6

Chapter 7 : Real time without RTOS
 	
    • Choosing the SW environment
    • Deriving real time performance from non-real time system
    • Scheduling and data sampling
    • Controlling from an external switch
    • Problems
	8
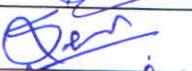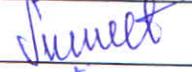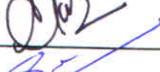
*Contact hours=12

Sr. No.	BOS member		Sign
1	Dr. Razak Sayyed	Subject Expert	
2	Prof. Abhijit Sathe	Subject Expert	
3	Prof. Sonali Deshmukh	Subject Expert	
4	Mr. Sumeet Kakroo	Industry Expert	
5	Ms. Jyoti Sharma	Alumni	
6	Prof. Ashwini Kulkarni	Chairman	
7	Prof. Swati Pulate	Internal Faculty	
8	Prof. Smita Borkar	Internal Faculty	

Reference Books:

1. Steve Heath Embedded Systems Design
2. Michael Barr :Programming Embedded Systems
3. Jean J. Labrosse :Embedded Systems Building Blocks
4. David E. Simon : An Embedded Software Primer published by Pearson Educations ISBN-13: 978-93-5134-153-6

Sr. No.	BOS member		Sign
1	Dr. Razak Sayyed	Subject Expert	
2	Prof. Abhijit Sathe	Subject Expert	
3	Prof. Sonali Deshmukh	Subject Expert	
4	Mr. Sumeet Kakroo	Industry Expert	
5	Ms. Jyoti Sharma	Alumni	
6	Prof. Ashwini Kulkarni	Chairman	
7	Prof. Swati Pulate	Internal Faculty	
8	Prof. Smita Borkar	Internal Faculty	