

**M.Sc. Computer Science Syllabus Second Year (2019-24) (Sem - IV)**  
**Embedded Systems**




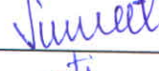




<b>Semester IV</b>	<b>Subject Code: MSE41903</b>	<b>Lectures: 60</b>
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**Objectives:**

The syllabus aims in equipping students with,

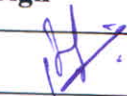
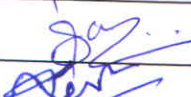
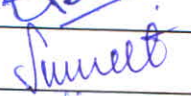
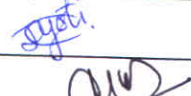
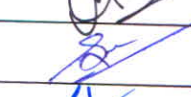



- design embedded systems and real-time systems
- understanding real-time systems:
- Apply real-time systems design techniques to various software programs.
- understanding embedded systems, it will enable you to :
  - Understand the basics of an embedded system
  - Program an embedded system

<b>Unit 1: Introduction to ES</b>	<b>08</b>
<b>Chapter 1 : Introduction to ES</b> <ul style="list-style-type: none"> <li>• What is ES</li> <li>• Examples of ES</li> <li>• Inside ES : processor, memory, peripherals, software</li> </ul>	<b>02</b>
<b>Chapter 2 : Embedded Processors , Memories &amp; Peripherals</b> <ul style="list-style-type: none"> <li>• Microcontrollers 8051</li> <li>• Discrete processors : 8-bit architecture, 16/32 bit CISC, RISC, DSP</li> <li>• Integrated processors : ARM RISC</li> <li>• Choosing a processor</li> <li>• Memory systems : types (SRAM, DRAM, FLASH), organization, access time, validating the contents of memory</li> <li>• Basic peripherals : parallel ports, timers, clocks</li> </ul>	<b>06</b>

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	



<b>Unit 2: Software for embedded systems</b>	<b>20</b>
<p><b>Chapter 3 : Real time system concepts</b></p> <ul style="list-style-type: none"> <li>• Foreground/ background systems</li> <li>• Critical section of code</li> <li>• Resource, shared resource</li> <li>• Multitasking, task, task switch</li> <li>• Kernel, scheduler, non-preemptive kernel, preemptive kernel</li> <li>• Reentrancy, round-robin scheduling</li> <li>• Task priority, static priority, dynamic priority, priority inversions, assigning task priorities</li> <li>• Mutual exclusion, deadlock, synchronization, event flags, intertask communication</li> <li>• 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)</li> </ul>	<b>12</b>
<p><b>Chapter 4 : Writing software for embedded systems</b></p> <ul style="list-style-type: none"> <li>• The compilation process : compile, link, load</li> <li>• Cross compilers</li> <li>• Run-time-libraries : processor dependent, I/O dependent, system calls,exit routines</li> <li>• Writing a library, using alternative libraries</li> <li>• Porting Kernels</li> <li>• C extensions for embedded systems</li> <li>• 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</li> <li>• Downloading</li> </ul>	<b>8</b>

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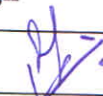

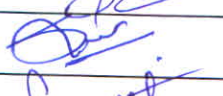



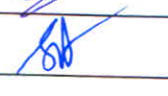



## Unit 3: Basic design using RTOS

20

<b>Chapter 5 : Emulation and Debugging techniques</b> <ul style="list-style-type: none"> <li>• Debugging techniques : <ul style="list-style-type: none"> <li>▪ HLL simulation, low level simulation, on-board debugger, task level debugging, symbolic debug</li> </ul> </li> <li>• Emulation</li> <li>• Optimization problems</li> </ul>	6
<b>Chapter 6 : Basic design using RTOS</b> <ul style="list-style-type: none"> <li>• Overview</li> <li>• Principles</li> <li>• Example</li> <li>• Encapsulating semaphores and queues</li> <li>• Hard real time scheduling considerations</li> <li>• Saving memory space</li> <li>• Saving power</li> </ul>	6
<b>Chapter 7 : Real time without RTOS</b> <ul style="list-style-type: none"> <li>• Choosing the SW environment</li> <li>• Deriving real time performance from non-real time system</li> <li>• Scheduling and data sampling</li> <li>• Controlling from an external switch</li> <li>• Problems</li> </ul>	8




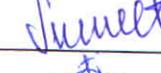



\*Contact hours=12

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**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

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