

<b>COURSE CODE</b>	<b>COURSE NAME</b>	<b>L-T-P-C</b>	<b>YEAR OF INTRODUCTION</b>
<b>EC308</b>	<b>Embedded Systems</b>	<b>3-0-0 -3</b>	<b>2016</b>
<b>Prerequisite:</b> EC206 Computer Organization, EC305 Microprocessors & Microcontrollers			
<b>Course objectives:</b> <ul style="list-style-type: none"> <li>• To have a thorough understanding of the basic structure and design of an Embedded System</li> <li>• To study the different ways of communicating with I/O devices and standard I/O interfaces.</li> <li>• To study the basics of RTOS for Embedded systems.</li> <li>• To study the programming concepts of Embedded Systems</li> <li>• To study the architecture of System-on-Chip and some design examples.</li> </ul>			
<b>Syllabus:</b> Introduction to Embedded Systems, Embedded system design process, Serial and parallel communication standards and devices, Memory devices and device drivers, Programming concepts of embedded programming - Embedded C++ and embedded java, Real Time Operating Systems Micro C/OS-II.			
<b>Expected outcome:</b> The students will be able to: <ol style="list-style-type: none"> <li>Understand the basics of an embedded system</li> <li>Develop program for an embedded system.</li> <li>Design, implement and test an embedded system.</li> </ol>			
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. David E. Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.</li> <li>2. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers - Elsevier 3ed, 2008</li> </ol>			
<b>References:</b> <ol style="list-style-type: none"> <li>1. Frank Vahid and Tony Givargis, Embedded Systems Design – A Unified Hardware / Software Introduction, John Wiley, 2002</li> <li>2. Iyer - Embedded Real time Systems, 1e, McGraw Hill Education New Delhi, 2003</li> <li>3. K.V. Shibu, Introduction to Embedded Systems, 2e, McGraw Hill Education India, 2016.</li> <li>3. Lyla B. Das, Embedded Systems: An Integrated Approach, 1/e , Lyla B. Das, Embedded Systems, 2012</li> <li>4. Rajkamal, Embedded Systems Architecture, Programming and Design, TMH, 2003</li> <li>5. Steve Heath, Embedded Systems Design, Newnes – Elsevier 2ed, 2002</li> <li>6. Tammy Noergaard, Embedded Systems Architecture, A Comprehensive Guide for Engineers and Programmers, Newnes – Elsevier 2ed, 2012</li> </ol>			

Course Plan			
Module	Course content	Hours	End Sem. Exam Marks
I	Introduction to Embedded Systems– Components of embedded system hardware–Software embedded into the system – Embedded Processors - CPU architecture of ARM processor (ARM9) – CPU Bus Organization and Protocol.	4	15
	Design and Development life cycle model - Embedded system design process – Challenges in Embedded system design	3	
II	Serial Communication Standards and Devices - UART, HDLC, SCI and SPI.	3	15
	Serial Bus Protocols - I2C Bus, CAN Bus and USB Bus. Parallel communication standards ISA, PCI and PCI-X Bus.	3	
FIRST INTERNAL EXAM			
III	Memory devices and systems - memory map – DMA - I/O Devices – Interrupts - ISR – Device drivers for handling ISR – Memory Device Drivers – Device Drivers for on-board bus.	6	15
IV	Programming concepts of Embedded programming – Features of Embedded C++ and Embedded Java (basics only). Software Implementation, Testing, Validation and debugging, system-on-chip.	6	15
	Design Examples: Mobile phones, ATM machine, Set top box	1	0
SECOND INTERNAL EXAM			
V	Inter Process Communication and Synchronization -Process, tasks and threads –Shared data– Inter process communication - Signals – Semaphore – Message Queues – Mailboxes – Pipes – Sockets – Remote Procedure Calls (RPCs).	8	20
VI	Real time operating systems - Services- Goals – Structures - Kernel - Process Management – Memory Management – Device Management – File System Organization. Micro C/OS-II RTOS - System Level Functions – Task Service Functions – Memory Allocation Related Functions – Semaphore Related Functions. Study of other popular Real Time Operating Systems.	8	20
END SEMESTER EXAM			

### **Question Paper Pattern ( End semester exam)**

**Maximum Marks : 100**

**Time : 3 hours**

The question paper shall consist of three parts. Part A covers modules I and II, Part B covers modules III and IV, and Part C covers modules V and VI. Each part has three questions uniformly covering the two modules and each question can have maximum four subdivisions. In each part, any two questions are to be answered. Mark patterns are as per the syllabus with 100 % for theory.

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