

## EMBEDDED SYSTEMS

<b>VII Semester: ECE</b>								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEC016	Core	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
<b>Contact Classes: 45</b>		<b>Tutorial Classes: 15</b>		<b>Practical Classes: Nil</b>			<b>Total Classes: 60</b>	
<p><b>OBJECTIVES:</b>  <b>The students will try to learn:</b></p> <ul style="list-style-type: none"> <li>I The fundamental concepts of embedded computing, embedded C, RTOS and embedded software development tools for implementing of real time embedded systems.</li> <li>II The embedded C is required to develop the software for different applications of the embedded systems.</li> <li>III The basics of various development tools are necessary to develop an embedded software.</li> <li>IV The architecture and memory organization of advanced general purpose microprocessors and digital signal processors like ARM and SHARC.</li> </ul> <p><b>COURSE OUTCOMES:</b></p> <ul style="list-style-type: none"> <li>CO 1 <b>Summarize</b> the applications of embedded systems in various domains.</li> <li>CO 2 <b>Analyze</b> the embedded system design process, characteristics and quality attributes of an embedded system.</li> <li>CO 3 <b>Apply</b> the looping structure concept to the programming of embedded C.</li> <li>CO 4 <b>Analyze</b> the concepts of interfacing modules using embedded C programming.</li> <li>CO 5 <b>Evaluate</b> the basic techniques used in interfacing in terms of reading and writing data from I/O port pins.</li> <li>CO 6 <b>Develop</b> the embedded software using the basics and fundamentals of RTOS.</li> <li>CO 7 <b>Demonstrate</b> the multiprocessing and multitasking in real time operating system to estimate the performance of embedded system.</li> <li>CO 8 <b>Describe</b> the process of task communication using shared memory and message passing.</li> <li>CO 9 <b>Illustrate</b> the implementation of real-time operating system using task communication and task synchronization.</li> <li>CO 10 <b>List</b> the embedded software development tools for getting embedded software into the target system.</li> <li>CO 11 <b>Describe</b> the concepts of advanced processors in terms of ARM and SHARC processors.</li> <li>CO 12 <b>Explain</b> the memory organization and instruction level parallelism in advanced processors.</li> </ul>								

<b>MODULE-I</b>	<b>EMBEDDED COMPUTING</b>	<b>Classes: 08</b>
Definition of embedded system, embedded systems vs. general computing systems, history of embedded systems, complex systems and microprocessor, classification, major application areas, the embedded system design process, characteristics and quality attributes of embedded systems, formalisms for system design, design examples.		
<b>MODULE-II</b>	<b>INTRODUCTION TO EMBEDDED C AND APPLICATIONS</b>	<b>Classes: 09</b>
C looping structures, register allocation, function calls, pointer aliasing, structure arrangement, bit fields, unaligned data and endianness, inline functions and inline assembly, portability issues; Embedded systems programming in C, binding and running embedded C program in Keil IDE, dissecting the program, building the hardware; Basic techniques for reading and writing from I/O port pins, switch bounce; Applications: Switch bounce, LED interfacing, interfacing with keyboards, displays, D/A and A/D conversions, multiple interrupts, serial data communication using embedded C interfacing.		
<b>MODULE -III</b>	<b>RTOS FUNDAMENTALS AND PROGRAMMING</b>	<b>Classes: 09</b>
Operating system basics, types of operating systems, tasks and task states, process and threads, multiprocessing and multitasking, how to choose an RTOS ,task scheduling, semaphores and queues, hard real-time scheduling considerations, saving memory and power. Task communication: Shared memory, message passing, remote procedure call and sockets; Task synchronization: Task communication synchronization issues, task synchronization techniques, device drivers.		
<b>MODULE -IV</b>	<b>EMBEDDED SOFTWARE DEVELOPMENT TOOLS</b>	<b>Classes: 09</b>
Host and target machines, linker/locators for embedded software, getting embedded software into the target system; Debugging techniques: Testing on host machine, using laboratory tools, an example system.		
<b>MODULE -V</b>	<b>INTRODUCTION TO ADVANCED PROCESSORS</b>	<b>Classes: 10</b>
Introduction to advanced architectures: ARM and SHARC, processor and memory organization and instruction level parallelism; Networked embedded systems: Bus protocols, I2C bus and CAN bus; Internet-Enabled systems, design example-Elevator controller.		
<b>Text Books:</b>		
<ol style="list-style-type: none"> <li>1. Shibu K.V, “Introduction to Embedded Systems”, Tata McGraw Hill Education Private Limited, 2<sup>nd</sup> Edition, 2009.</li> <li>2. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, Tata McGraw-Hill Education, 2<sup>nd</sup> Edition, 2011.</li> <li>3. Andrew Sloss, Dominic Symes, Wright, “ARM System Developer's Guide Designing and Optimizing System Software”, 1<sup>st</sup> Edition, 2004.</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. Wayne Wolf, “ Computers as Components, Principles of Embedded Computing Systems Design”, Elsevier, 2nd Edition, 2009.</li> <li>2. Dr. K. V. K. K. Prasad, “ Embedded / Real-Time Systems: Concepts, Design &amp; Programming”, dreamtech publishers, 1<sup>st</sup> Edition, 2003.</li> <li>3. Frank Vahid, Tony Givargis, “Embedded System Design”, John Wiley &amp; Sons, 3<sup>rd</sup> Edition, 2006.</li> <li>4. Lyla B Das, “Embedded Systems” , Pearson Education, 1<sup>st</sup> Edition, 2012.</li> <li>5. David E. Simon, “An Embedded Software Primer”, Addison-Wesley, 1<sup>st</sup> Edition, 1999.</li> <li>6. Michael J.Pont, “Embedded C”, Pearson Education, 2<sup>nd</sup> Edition, 2008.</li> </ol>		

**Web References:**

1. <http://www.igniteengineers.com>
2. <http://www.ocw.nthu.edu.tw>
3. <http://www.uotechnology.edu.iq>
4. <http://www.nptel.com>

**E-Text Books:**

1. [https://www.jntubook.com/embedded systems-textbook](https://www.jntubook.com/embedded%20systems-textbook)
2. <http://trdownload.com/results/neamen-embedded-systems-.html>
3. <http://www.everythingvtu.wordpress.com>