

## EMBEDDED SYSTEMS DESIGN AND PROGRAMMING

<b>VIII Semester: EEE</b>								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEC024	Core	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
<b>Contact Classes: 45</b>		<b>Tutorial Classes: 0</b>		<b>Practical Classes: Nil</b>			<b>Total Classes: 45</b>	
<p><b>OBJECTIVES:</b>  <b>The Students Will Try To Learn:</b></p> <p>I     The fundamental concepts of embedded computing, embedded C, RTOS and embedded software tools for implementing embedded systems.</p> <p>II    Embedded software development tools for debugging and testing of embedded applications, architectures of ARM and SHARC processors.</p> <p>III   Interfacing with external environments using sensors, actuators and communication in distributed embedded systems.</p> <p><b>COURSE OUTCOMES:</b>  <b>After successful completion of the course, Students will be able to:</b></p> <p>CO 1 <b>Illustrate</b> the concepts of embedded systems using their architectures.</p> <p>CO 2 <b>Summarize</b> the hardware functionality of embedded system for rapid design and programming embedded systems.</p> <p>CO 3 <b>Apply</b> the integration of sensors, actuators and on-chip peripherals of microcontroller architectures for prototype design.</p> <p>CO 4 <b>Demonstrate</b> the principles of RTOS such as interrupt latency and context switching in hard real time environments.</p> <p>CO 5 <b>Make use of</b> embedded software development tools for debugging and testing of embedded applications.</p> <p>CO 6 <b>Demonstrate</b> the multiprocessing and multitasking in real time operating system for estimating the performance of embedded system.</p> <p>CO 7 <b>Analyze</b> the task communication and task synchronization for implementation of real-time operating systems.</p> <p>CO 8 <b>Build</b> time constrained embedded systems using the concepts of real time operating systems.</p> <p>CO 9 <b>Illustrate</b> the architecture, memory management, instruction level parallelism and application development using ARM and SHARC processors.</p> <p>CO10 <b>Model</b> a embedded application prototype using embedded C.</p> <p>CO11 <b>Construct</b> the time constrained application alone or as a member of a small group to meet design specifications.</p> <p>CO12 <b>Understand</b> the concepts of Internet of Things for building the embedded systems applications.</p>								
<b>MODULE-I</b>	<b>EMBEDDED COMPUTING</b>						<b>Classes: 09</b>	
<p>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</p>								

<b>MODULE-II</b>	<b>PROGRAMMING EMBEDDED SYSTEMS IN C</b>	<b>Classes: 09</b>
<p>Embedded systems programming in C, binding and running embedded C program in Keil IDE, building the hardware; The Project Header (MAIN.H), The Port Header (PORT.H), Example: Restructuring the “Hello Embedded World” example.</p>		
<b>MODULE-III</b>	<b>EMBEDDED C APPLICATIONS</b>	<b>Classes: 09</b>
<p>Basic techniques for reading from port pins, Example: Reading and writing bytes, Example: Reading and writing bits (simple version), Example: Reading and writing bits (generic version).  Basic techniques for reading and writing from I/O port pins, LED interfacing, interfacing with keyboards, displays, Stepper motor interfacing.</p>		
<b>MODULE-IV</b>	<b>INTRODUCTION TO REAL-TIME OPERATING SYSTEMS</b>	<b>Classes: 09</b>
<p>Tasks and Task States, Semaphores, and Shared Data; Message Queues, Mailboxes and Pipes, Timer Functions, Events, Semaphores and Queues, Hard Real-Time Scheduling Considerations, Interrupt Routines in an RTOS Environment.  Embedded Software Development Tools: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System; Debugging Techniques: Testing on Host Machine.</p>		
<b>MODULE-V</b>	<b>INTRODUCTION TO ADVANCED ARCHITECTURES</b>	<b>Classes: 09</b>
<p>ARM and SHARC, Processor and memory organization and Instruction level parallelism; Networked embedded systems: Bus protocols, I2C bus and CAN bus.</p>		
<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. Labrosse, “Embedding system building blocks”, CMP publishers.</li> <li>2. Raj Kamal, “Embedded Systems”, TMH.</li> <li>3. Micro Controllers, Ajay V Deshmukhi, TMH.</li> <li>4. Frank Vahid, Tony Givargis, “Embedded System Design”, John Wiley</li> <li>5. Raj kamal, “Microcontrollers”, Pearson Education.</li> <li>6. David E. Simon, “An Embedded Software Primer”, Pearson Education.</li> <li>7. Muhammad Ali Mazadi, Janice Mazidi, Janice Gillispie Mazdi, “8051 Microcontroller and Embedded Systems”.</li> </ol>		
<b>Web References:</b>		
<ol style="list-style-type: none"> <li>1. <a href="https://www.smartworld.com/notes/embedded-systems-es/">https://www.smartworld.com/notes/embedded-systems-es/</a></li> <li>2. <a href="http://notes.specworld.in/embedded-systems-es/">http://notes.specworld.in/embedded-systems-es/</a></li> <li>3. <a href="http://education.uandistar.net/jntu-study-materials">http://education.uandistar.net/jntu-study-materials</a></li> <li>4. <a href="http://www.nptelvideos.in/2012/11/embedded-systems.html">http://www.nptelvideos.in/2012/11/embedded-systems.html</a></li> </ol>		
<b>E-Text Books:</b>		
<ol style="list-style-type: none"> <li>1. <a href="https://www.scribd.com/doc/233633895/Intro-to-Embedded-Systems-by-Shibu-Kv">https://www.scribd.com/doc/233633895/Intro-to-Embedded-Systems-by-Shibu-Kv</a></li> <li>2. <a href="http://www.ee.eng.cmu.ac.th/~demo/think/_DXJSq9r3TvL.pdf">http://www.ee.eng.cmu.ac.th/~demo/think/_DXJSq9r3TvL.pdf</a></li> </ol>		

3. <https://www.scribd.com/doc/55232437/Embedded-Systems-Raj-Kamal>
4. [https://docs.google.com/file/d/0B6Cyt14eS\\_ahUS1LTkVXb1hxa00/edit](https://docs.google.com/file/d/0B6Cyt14eS_ahUS1LTkVXb1hxa00/edit)
5. <http://www.ecpe.nu.ac.th/ponpisut/22323006-Embedded-c-Tutorial-8051.pdf>