



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

## COURSE CONTENT

EMBEDDED SYSTEMS								
OE –II: VII Semester: CSE / CSE (AI & ML) / CSE (DS) / CSE (CS) / CSIT / IT								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
AECC40	Elective	3	-	-	3	30	70	100
<b>Contact Classes: 45</b>		<b>Tutorial Classes: Nil</b>		<b>Practical Classes: Nil</b>		<b>Total Classes: 45</b>		
<b>I. COURSE OVERVIEW:</b>								
<p>This course allows students to learn the fundamentals of embedded system hardware and firmware design. It focus on embedded system design process, embedded C, interfacing modules, software development tools for debugging and testing of embedded applications, ARM &amp; SHARC processor architectures and memory organization. It provides hands-on experience on implementation of embedded application prototype design using embedded C.</p>								
<b>II. COURSE OBJECTIVES:</b>								
<b>The students will try to learn:</b>								
<ol style="list-style-type: none"> <li>I. The fundamental concepts of embedded computing, embedded C, RTOS and embedded software tools for implementing embedded systems.</li> <li>II. The Embedded the software development tools for debugging and testing of embedded applications, architectures of ARM and SHARC processors.</li> <li>III. The interface with external environments using sensors, actuators and communication in distributed embedded systems.</li> </ol>								
<b>III. SYLLABUS:</b>								
<b>MODULE –I: EMBEDDED COMPUTING (08)</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: INTRODUCTION TO EMBEDDED C AND APPLICATIONS (09)</b>								
<p>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.</p>								
<b>MODULE –III: RTOS FUNDAMENTALS AND PROGRAMMING (09)</b>								
<p>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.</p> <p>Task communication: Shared memory, message passing, remote procedure call and sockets; Task synchronization: Task communication synchronization issues, task synchronization techniques, device drivers.</p>								
<b>MODULE –IV: EMBEDDED SOFTWARE DEVELOPMENT TOOLS (09)</b>								
<p>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.</p>								
<b>MODULE –V: INTRODUCTION TO ADVANCED PROCESSORS (10)</b>								
<p>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.</p>								

#### **IV. TEXT BOOKS**

1. Shibu K.V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2<sup>nd</sup> Edition, 2009.
2. Raj Kamal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw-Hill Education, 2<sup>nd</sup> Edition, 2011.
3. Andrew Sloss, Dominic Symes, Wright, "ARM System Developer's Guide Designing and Optimizing System Software", 1<sup>st</sup> Edition, 2004.

#### **V. REFERENCE BOOKS**

1. Wayne Wolf, "Computers as Components, Principles of Embedded Computing Systems Design", Elsevier, 2<sup>nd</sup> Edition, 2009.
2. Dr. K. V. K. K. Prasad, "Embedded / Real-Time Systems: Concepts, Design & Programming", Dreamtech publishers, 1<sup>st</sup> Edition, 2003.
3. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley & Sons, 3<sup>rd</sup> Edition, 2006.
4. Lyla B Das, "Embedded Systems", Pearson Education, 1<sup>st</sup> Edition, 2012.
5. David E. Simon, "An Embedded Software Primer", Addison-Wesley, 1<sup>st</sup> Edition, 1999.
6. Michael J. Pont, "Embedded C", Pearson Education, 2<sup>nd</sup> Edition, 2008.

#### **VI. WEB REFERENCES**

1. <https://www.smartworld.com/notes/embedded-systems-es/>
2. <http://notes.specworld.in/embedded-systems-es/>
3. <http://education.uandistar.net/jntu-study-materials>
4. <http://www.nptelvideos.in/2012/11/embedded-systems.html>

#### **VII. E-TEXT BOOKS**

1. <https://www.scribd.com/doc/233633895/Intro-to-Embedded-Systems-by-Shibu-Kv>
2. [http://www.ee.eng.cmu.ac.th/~demo/think/\\_DXJSq9r3TvL.pdf](http://www.ee.eng.cmu.ac.th/~demo/think/_DXJSq9r3TvL.pdf)
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>