EMBEDDED SYSTEMS

VII Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEC016	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The students will try to learn:

I The fundamental concepts of embedded computing, embedded C, RTOS and embedded software tools for implementing embedded systems.

II Embedded software development tools for debugging and testing of embedded applications, architectures of ARM and SHARC processors.

III Interfacing with external environments using sensors, actuators and communication in distributed embedded systems.

COURSE OUTCOMES:

CO 1 **Illustrate** the concepts of embedded systems using their architectures.

CO 2 **Summarize** the hardware functionality of embedded system for rapid design and programming embedded systems.

CO 3 **Apply** the integration of sensors, actuators and on-chip peripherals of microcontroller architectures for prototype design.

CO 4 **Demonstrate** the principles of RTOS such as interrupt latency and context switching in hard real time environments.

CO 5 **Make use of** embedded software development tools for debugging and testing of embedded applications.

CO 6 **Demonstrate** the multiprocessing and multitasking in real time operating system for estimating the performance of embedded system.

CO 7 **Analyze** the task communication and task synchronization for implementation of real-time operating systems.

CO 8 **Build** time constrained embedded systems using the concepts of real time operating systems.

CO 9 **Illustrate** the architecture, memory management, instruction level parallelism and application development using ARM and SHARC processors.

CO 10 **Model** a embedded application prototype using embedded C.

CO 11 **Construct** the time constrained application alone or as a member of a small group to meet design specifications.

CO 12 **Understand** the concepts of Internet of Things for building the embedded systems applications.

MODULE-I	EMBEDDED COMPUTING	Classes: 08
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.		
MODULE-II	**INTRODUCTION TO EMBEDDED C AND APPLICATIONS**	**Classes: 09**
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.		
MODULE -III	**RTOS FUNDAMENTALS AND PROGRAMMING**	**Classes: 09**
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.		
MODULE -IV	**EMBEDDED SOFTWARE DEVELOPMENT TOOLS**	**Classes: 09**
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.		
MODULE -V	**INTRODUCTION TO ADVANCED PROCESSORS**	**Classes: 10**
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.		

Text Books:

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

Reference Books:

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

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 2. http://tradownload.com/results/neamen-embedded-systems-.html 3. http://www.everythingvtu.wordpress.com