COURSE CONTENT

EMBEDDED SYSTEM DESIGN

VII Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AECC43	**Core**	3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

Prerequisites: Microprocessors and Microcontrollers

I. COURSE OVERVIEW:
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 & SHARC processor architectures and memory organization. It provides hands-on experience on implementation of embedded application prototype design using embedded C.

II. COURSE 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.

III. COURSE SYLLABUS:
MODULE –I: EMBEDDED COMPUTING (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: TYPICAL EMBEDDED SYSTEMS AND ITS APPLICATIONS (09)
Typical Embedded System: Core of the Embedded System, General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS).
Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Communication Interface: Onboard and External Communication Interfaces.
Applications: LED interfacing, LCD display, Seven segment display, DAC and ADC converters interfacing with 8051 Microcontroller.

MODULE –III: RTOS FUNDAMENTALS AND PROGRAMMING (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 (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 (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.

IV. 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.

V. 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.

VI. WEB REFERENCES:

1. http://www.ee.iitkgp.ac.in
2. http://www.citchennai.edu.in