INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

EMBEDDED SYSTEM DESIGN AND DEVELOPMENT								
VII Semester: ECE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AECD47	**Core**	3	-	-	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:48**		
Prerequisite: Embedded System Design								

I. COURSE OVERVIEW:
This course allows students to learn the fundamentals of embedded system hardware and firmware design. It focusses on the 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 in the implementation of embedded application prototype design using embedded C.

II. COURSES 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. The analytical skills needed to model analog and digital integrated circuits (IC) at discrete and circuit level
III. Interfacing with external environments using sensors, actuators, and communication in distributed embedded systems.

III. COURSE OUTCOMES:
At the end of the course, students should be able to:

CO 1 Summarize the concepts of Embedded Systems and formalisms for system design with examples.
CO 2 Examine and write the Embedded Systems programming in C with Keil Integrated Development Environment (IDE).
CO3 Demonstrate the principles of RTOS and the methods used for saving memory and power in real- time environments.
CO4 Make use of embedded software development tools for debugging and testing of embedded applications.
CO5 Illustrate the architecture, memory organization, and instruction level parallelism of ARM and SHARC processors used in Embedded Systems.
CO6 Interpret the concepts of the Internet of Things used in the embedded systems applications and development.

IV. COURSE CONTENT:

MODULE –I: EMBEDDED COMPUTING (09)

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 (10)

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 (10)

Host and target machines, linker/locators for embedded software, getting embedded software into the target system; Debugging techniques: Testing on the host machine, using laboratory tools, an example system.

MODULE –V: EMBEDDED SYSTEMS - DESIGN AND DEVELOPMENT (10)

System Design and Development, Life Cycle Models, Problem Solving, The Design Process, Identifying the Requirements, Formulating the Requirements Specification, The System Design Specification, System Specifications versus System Requirements, Partitioning and Decomposing a System, Architectural Design Other Considerations, Archiving the Project.

V. TEXTBOOKS:

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.

VI. 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.

VII. ELECTRONICS RESOURCES:

1. NPTEL:: Electrical, Electronics, and Communication: Embedded System Design and Development
2. NPTEL:: Electronics and Communication - NOC: RTO’s fundamentals
3. NPTEL:: Electronics and Communication - NOC: Embedded C
4. https://khub.nthu.edu.tw/

5. NPTEL:: Electrical, Electronics and Communication: Embedded System Design

6. VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Definition and terminology
4. Tech-talk topics
5. Assignments
6. Model question paper - I
7. Model question paper - II
8. Lecture notes
9. Early learning readiness videos (ELRV)
10. PowerPoint presentations