

## EMBEDDED SYSTEM DESIGN AND ARCHITECTURE

I Semester: ECE(ES)								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BESC01	Core	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes:45			

### I. COURSE OVERVIEW:

This course allows the students to learn the fundamentals of embedded system hardware and firmware design. It focuses on basics of embedded systems, embedded firmware design approaches, development languages and system design. The knowledge acquired from this course will enable the students to implement embedded hardware projects and models for engineering and scientific applications.

### II. COURSE OBJECTIVES:

The students will try to learn:

- I. The basics of embedded systems then the difference between embedded systems and general purpose systems.
- II. The embedded firmware design approaches and development languages.
- III. The typical engineering issues of embedded software development.

### III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	<b>Demonstrate</b> the concepts of embedded systems and formalisms for System design	Understand
CO2	<b>Apply</b> the suitable memory technology and other components for different applications to meet the ever growing needs of the embedded applications.	Apply
CO3	<b>Choose</b> the fundamental components that make up an embedded board to implement an Instruction Set Architecture's features in a processor	Apply
CO4	<b>Categorize</b> the embedded firmware design approaches and development languages used for programming embedded devices.	Analyze
CO5	<b>Make use of</b> the memory hierarchy to minimize the access time in embedded architecture design.	Apply
CO6	<b>Identify</b> the hardware software co- design issues pertaining to design of an embedded system using low power microcontrollers.	Apply

### IV. SYLLABUS:

#### MODULE – I: INTRODUCTION TO EMBEDDED SYSTEMS (09)

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems. Core of the Embedded System: ASICs, PLDs, Commercial Off-The-Shelf Components (COTS).

#### MODULE – II: EMBEDDED FIRMWARE (09)

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit. Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Sensors and Actuators, Communication Interface. Embedded Firmware Design Approaches and Development Languages. Introduction, object oriented programming with C, the project header (main.h), the port header (port.h).

#### MODULE – III: PROCESSOR HARDWARE (09)

Embedded system model, Embedded board using Von Neuman model; EMBEDDED processors: ISA architecture models-application specific ISA models and general purpose ISA models.

Internal processor design: ALU, registers, control unit, clock, on chip memory, processor i/o, interrupts, processor buses, processor performance.

#### **MODULE – IV: SOFTWARE (09)**

Board memory: ROM, RAM, cache, auxiliary memory, memory management, memory performance. Middleware and applications: PPP, IP middleware UDP, Java. Application layer: FTP client, SMTP, HTTP server and client.

#### **MODULE – V: SYSTEM DESIGN (09)**

Design and development: architectural patterns and reference models: Creating the architectural structures- documenting the architecture-analyzing and evaluating the architecture-debugging testing, and maintaining.

#### **V. TEXT BOOKS:**

1. Frank Vahid, Tony Givargis, “Embedded System Design”, John Wiley Publications, 3<sup>rd</sup> Edition, 2006.
2. Shibu K.V, “Introduction to Embedded Systems”, McGraw Hill, 3<sup>rd</sup> Edition, 2006.

#### **VI. REFERENCE BOOKS:**

1. Tammy Noergaard, “Embedded system architecture”, Elsevier, 2006.
2. Jean J. Labrosse, “Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C”, The publisher, Paul Temme, 2011.
3. Raj Kamal, “Embedded Systems”, TMH, 2<sup>nd</sup> Edition, 2008.
4. Shibu K.V, “Introduction to Embedded Systems, McGraw Hill, 3<sup>rd</sup> Edition, 2012.
5. Lyla, “Embedded Systems”, Pearson Education, 2<sup>nd</sup> Edition, 2013.

#### **VII. WEB REFERENCES:**

1. <http://www.nptelvideos.in/2012/11/embedded-systems.html>
2. [http://nptel.iitg.ernet.in/courses/Elec\\_Engg/IIT%20Delhi/Embedded%20Systems%20\(Video\).html](http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Delhi/Embedded%20Systems%20(Video).html)
3. <http://www.sciencedirect.com/science/book/9780750677929>
4. [https://books.google.co.in/books/about/Embedded\\_systems.html?id=tgLm2g8KnH0C](https://books.google.co.in/books/about/Embedded_systems.html?id=tgLm2g8KnH0C)

#### **VIII. 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. <http://www.ecpe.nu.ac.th/ponpisut/22323006-Embedded-c-Tutorial-8051.pdf>