EMBEDDED SYSTEMS DESIGN

I Semester: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESB01	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course is 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 difference between embedded systems and general purpose systems.
II. The hardware designs of custom single-purpose processors.
III. How to compare different approaches in optimizing general-purpose processors.
IV. The different peripheral interfaces to embedded systems.

III. COURSE OUTCOMES:

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

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

IV. SYLLABUS:

UNIT-I	INTRODUCTION TO EMBEDDED SYSTEMS	Classes: 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.

UNIT-II	TYPICAL EMBEDDED SYSTEM	Classes: 09

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, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT-III	**EMBEDDED FIRMWARE**	**Classes: 09**
Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.		
UNIT-IV	**RTOS BASED EMBEDDED SYSTEM DESIGN**	**Classes: 09**
Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.		
UNIT-V	**TASK COMMUNICATION**	**Classes: 09**
Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.		

Text Books:

1. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley Publications, 3rd Edition, 2006.

Reference Books:

1. Raj Kamal, "Embedded Systems", TMH, 2nd Edition, 2008.
2. Shibu K.V, "Introduction to Embedded Systems, McGraw Hill, 3rd Edition, 2012.
3. Lyla, "Embedded Systems", Pearson Education , 2nd Edition, 2013.

MICROCONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSING

I Semester: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESB02	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course is intended to provide fundamentals of ARM Cortex-M3 Processor and LPC 17XX Micro- controller architectures and their features. It includes the architectures of the Cortex-M3, instruction set summary, Programmable DSP processor. It is used in the applications of microcontrollers pro- gramming models and programmable digital signal processors.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Compare and select ARM processor core based SoC with several features/peripherals based on requirements of embedded applications.
II. Identify and characterize architecture of Programmable DSP Processors
III. Develop small applications by utilizing the ARM processor core and DSP processor based platform.

III. COURSE OUTCOMES:

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

CO 1	Illustrate the Internal architecture and memory operations of ARM Cortex M3 processor for interfacing microprocessor applications	Understand
CO 2	Analyze Exceptions handler mechanism to minimize interrupt latency using Nested Vectored Interrupt Controller	Analyze
CO 3	Construct the high level of integration in embedded applications using LPC 17XX Microcontroller	Apply
CO 4	Demonstrate various computational building blocks of programmable DSP architectures using interfacing of memory and I/O peripherals	Understand
CO 5	Identify the CPU architecture, peripherals, and development tools for the TMS320C6000 digital signal processors	Apply
CO 6	Develop the application for digital signal processing using code composer studio tool	Apply

IV. SYLLABUS:

UNIT-I	ARM CORTEX-M3 PROCESSOR	Classes: 09

ARM Cortex-M3 processor: Applications, Programming model – Registers, Operation modes, Exceptions and Interrupts, Reset Sequence Instruction Set, Unified Assembler Language, Memory Maps, Memory Access Attributes, Permissions, Bit-Band Operations, Unaligned and Exclusive Transfers. Pipeline, Bus Interfaces.

UNIT-II	EXCEPTIONS AND INTERRUPT	Classes: 09

Exceptions, Types, Priority, Vector Tables, Interrupt Inputs and Pending behaviour, Fault Exceptions, Supervisor and Pendable Service Call, Nested Vectored Interrupt Controller, Basic Configuration, SYSTICK Timer, Interrupt Sequences, Exits, Tail Chaining, Interrupt Latency.