EMBEDDED PROCESSORS AND PERIPHERALS

III Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC26	**ELECTIVE**	**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 provides the architectures and features of embedded processors to process instructions and data of embedded and system-on-chip designs. It focuses on the architecture of Embedded systems, ARM processors, and Cortex-M3and development tools for debugging. It gives the necessary background for design, development of embedded models for communication, industrial automation, automobiles, large and small house hold appliances.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The hardware and software architecture, features, challenges and debugging tools of embedded system.
II. The architecture and instruction set of ARM processor& Cortex-M3 with peripheralsto build embedded applications.
III. The case studies in the area of real time embedded applications using embedded processors.

III. COURSE OUTCOMES:

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

CO1	**Outline** the basic concepts and architectures of embedded system in real time applications.	Understand
CO2	**Illustrate**the challenges, design issues and cyclic process for the development of embedded system design.	Understand
CO3	**Demonstrate** the architecture and instruction set of ARM Processors for efficient embedded assembly language level programming.	Apply
CO4	**Make use of** memory and input/output peripherals to interface the programmable embedded devices for increasing time response of a system.	Apply
CO5	**Develop** embedded system programming using ARM thumb instruction set to increase the code density.	Apply
CO6	**Explore** the architecture and programming of Industry standard 32-bit popular ARM Cortex-M3 Microcontroller for high performance and low cost embedded devices.	Apply

IV. SYLLABUS:

MODULE – I: INTRODUCTION TO EMBEDDED SYSTEMS(9)

Overview of Embedded System Architecture, Challenges & Trends of Embedded Systems, Hardware Architecture, Software Architecture. Application areas of Embedded Systems and Categories of Embedded Systems. Embedded System Design and Co-Design issues and Design Cycle Process.

MODULE – II: ARM ARCHITECTURE(9)

ARM Design Philosophy, Registers, Program Status Register, Instruction Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families. Instruction Set: Data Processing Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions.

MODULE – III: ARM THUMB INSTRUCTION SET(9)

Register Usage, Other Branch Instructions, Data Processing Instruction Single-Register and Multi Register

Load-Store Instructions, Stack, Software Interrupt Instructions.

Exception and interrupt handling. ARM Memory Management: Cache Architecture, Polices, Flushing and Caches, MMU, Page Tables, Translation Access Permissions, Context Switch.

MODULE – IV: OVERVIEW OF CORTEX-M3(9)

Cortex-M3 Basics: Registers, General Purpose Registers, Stack Pointer, Link Register, Program Counter, Special Registers, Operation Mode, Exceptions and Interrupts, Vector Tables, Stack Memory Operations, Reset Sequence. Instruction Sets: Assembly Basics, Instruction List, Instruction Descriptions. Cortex-M3 Implementation Overview: Pipeline, Block Diagram, Bus Interfaces on Cortex-M3, I-Code Bus, D-Code Bus, System Bus, External PPB and DAP Bus.

MODULE – V:DEVELOPMENT& DEBUGGING TOOLS (9)

Software and Hardware tools like Cross Assembler, Compiler, Debugger, Simulator, In Circuit Emulator (ICE), Logic Analyzer etc. Case Studies: Design of Embedded Systems using Microcontrollers – for applications in the area of communication and automotive. (GSM/GPRS, CAN, ZigBee).

V. TEXT BOOKS:

1. Raj Kamal, "Embedded Systems – Architecture, Programming and Design", TMH, 2nd Edition, 2008.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM Systems Developer's Guides – Designing & Optimizing System Software", Elsevier, 2008.
3. Mazidi, MCKinlay and Danny Causey, "PIC Microcontrollers and Embedded Systems", Pearson Education, 2007.
4. David.E. Simon, "An Embedded Software Primer", Pearson Education, 1st Edition, 1999.
5. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", Elsevier Inc, 2nd Edition, 2010.
6. Prasad, KVK, "Embedded / Real Time Systems Concepts", Design and Programming Black Book", 1st Edition, 1999.
7. David Seal "ARM Architecture Reference Manual", 2001 Addison Wesley, England; Morgan Kaufmann Publishers.

VI. REFERENCE BOOKS:

1. Steve Furber, "ARM System-on-Chip Architecture", Pearson Education, 2nd Edition 2001.
2. Cortex-M series-ARM Reference Manual.
3. Cortex-M3 Technical Reference Manual (TRM).
4. STM32L152xx ARM Cortex M3 Microcontroller Reference Manual.
5. ARM Company Ltd. "ARM Architecture Reference Manual– ARM DDI 0100E".
6. ARM v7-M Architecture Reference Manual (ARM v7-M ARM).
7. Ajay Deshmukh, "Microcontroller - Theory & Applications", Tata McGraw Hill.

VII. WEB REFERENCES:

1. http://www.nptel.ac.in/downloads/106108100/
2. http://www.the8051microcontroller.com/web-references
3. http://www.iare.ac.in
4. https://books.google.co.in/books
5. http://www.www.jntubook.com
6. http://www.ebooklibrary.org/articles/mpmc
7. https://www.smartzworld.com/notes/embedded-systems-es/
8. http://notes.specworld.in/embedded-systems-es/
9. http://education.uandistar.net/jntu-study-materials