MICROCONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSING

I Semester: M.Tech. (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

OBJECTIVES:

The course should enable the students to:

1. 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

COURSE OUTCOMES (COs):

CO 1: Analyze the characteristics of ARM Cortex-M3 processor.
CO 2: Understand the various Exceptions and Interrupts in Cortex-M3 processor.
CO 3: Study the features of LPC 17xx microcontrollers based on Cortex-M3 processor.
CO 4: Identify and analyze the characteristics Programmable DSP Processors.
CO 5: Understand the TMS320C6000 series DSP Processor architectures.

COURSE LEARNING OUTCOMES (CLOs):

1. Understanding the ARM Cortex-M3 processor: Applications, Programming model – Registers, Operation modes, Exceptions and Interrupts, Reset Sequence.
2. Study the Instruction Set, Unified Assembler Language, Memory Maps, Memory Access Attributes, Permissions, Bit-Band Operations.
3. Discuss the Unaligned and Exclusive Transfers. Pipeline, Bus Interfaces.
4. Examine the various Exceptions, Types, Priority, Vector Tables, Interrupt Inputs and Pending behavior, Fault Exceptions
5. Discuss the Supervisor and Pendable Service Call, Nested Vectored Interrupt Controller.
6. Understand the Basic Configuration, SYSTICK Timer, Interrupt Sequences, Exits, Tail Chaining, Interrupt Latency.
7. Describe the LPC 17xx microcontroller- Internal memory, GPIOs, Timers.
8. Study the features of ADC, UART and other serial interfaces.
9. Understand the concepts of PWM, RTC, WDT
10. Describe the Programmable DSP (P-DSP) Processors: Harvard architecture, Multi port memory
11. Study the features of architectural structure of P-DSP- MAC unit, Barrel shifters.
12. Understand the Introduction to TI DSP processor family.
13. Study the VLIW architecture and TMS320C6000 series, architecture study, data paths, cross paths.
14. Understand the Introduction to Instruction level architecture of C6000 family, Assembly Instructions memory addressing, for arithmetic, logical operations.
15. Describe the Code Composer Studio for application development for digital signal processing, on chip peripherals, Processor benchmarking.

Unit-I	SYSTEMS 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 INTERRUPTS	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.

Unit -III	LPC 17XX MICROCONTROLLER	Classes:09

LPC 17xx microcontroller- Internal memory, GPIOs, Timers, ADC.

UART and other serial interfaces, PWM, RTC, WDT.

Unit -IV	PROGRAMMABLE DSP (P-DSP) PROCESSORS	Classes: 09

Programmable DSP (P-DSP) Processors: Harvard architecture, Multi port memory, architectural structure of P-DSP- MAC unit, Barrel shifters, Introduction to TI DSP processor family.

Unit -V	VLIW ARCHITECTURE	Classes: 09

VLIW architecture and TMS320C6000 series, architecture study, data paths, cross paths, Introduction to Instruction level architecture of C6000 family, Assembly Instructions memory addressing, for arithmetic, logical operations Code Composer Studio for application development for digital signal processing, On chip peripherals , Processor benchmarking

Text Books:

1. Joseph Yiu, "The definitive guide to ARM Cortex-M3", Elsevier, 3rd Edition, 2014.
2. Venkatramani B. and Bhaskar M. "Digital Signal Processors: Architecture, Programming and Applications", TMH, 2nd Edition, 2011.

Reference Books:

1. Sloss Andrew N, Symes Dominic, Wright Chris, "ARM System Developer's Guide: Designing and Optimizing", Morgan Kaufman Publications,
2. Steve furber, "ARM System-on-Chip Architecture", Pearson Education.
3. Frank Vahid and Tony Givargis, "Embedded System Design", Wiley Publications.

Web References:

1. http:// www.arm.com
2. http://nptel.ac.in/video.php?subjectId=112101099
3. https://developer.arm.com › docs

E-Text Books:

1. https://university.ti.com
2. http://www.everythingvtu.wordpress.com