| EC306 | Micro Controllers | PCC | 3-0-0 | 3 Credits |

Pre-requisites: EC201-Digital system design-I

Course Outcomes: After the completion of the course the student will be able to:

CO1	Understand the evolution of microprocessors and microcontrollers and its architectures
CO2	Understand the evolution and architectures of ARM processors.
CO3	Analyze and understand the instruction set and development tools of ARM
CO4	Understand the architectural features of ARM cortex M4 microcontrollers.
CO5	Understand the exception, interrupts and interrupt handling schemes
CO6	Understand the hardware and interfacing peripheral devices to ARM cortex M4

Mapping of course outcomes with program outcomes:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	-	3	-	-	-	-	-	-	-	-	2	-
CO2	-	3	-	3	-	-	-	-	1	-	-	-	2	-
CO3	-	3	-	-	-	-	-	-	1	-	-	-	2	-
CO4	-	2	-	3	-	-	-	-	1	-	-	-	2	-
CO5	-	2	-	3	-	-	-	-	1	-	-	-	2	-
CO6	2	2	-	-	-	-	-	-	-	-	-	-	2	-

Detailed Syllabus:
Introduction to Microprocessors and Microcontrollers:

Evolution and introduction of 80X86 microprocessor, Architecture of 8086, Memory organization, 8086 system connections and timing. Overview of 8051 microcontroller, Architecture, Instruction set and addressing modes, programming of I/O Ports, Interrupts, timer/ counter and serial communication.

Introduction to ARM Processors:

Introduction to ARM processors, Evolution of ARM processors, pipeline organization, ARM Processor cores and CPU cores. Introduction to ARM Cortex-M Processors, ARM Cortex-M4 processor's architecture, Programmer's model, Special registers, Operation Modes.

ARM Cortex-M4 programming: Assembly basics, Instruction set, Data transfer, Data processing, conditional and branch instructions, barrier and saturation operations, Cortex-M4-specific instructions,Thumb2 instructions, Keil Microcontroller Development Kit for ARM, Typical program compilation flow, Sample arithmetic and logical assembly language programs

ARM cortex-M4 Memory Systems and interrupts: Overview of memory system features, Memory map, Memory access attributes and permissions, Data alignment and unaligned data access support, Bit-band operations, Overview of exceptions and interrupts, Exception types, Overview of interrupt management, Definitions of priority, Vector table and vector table relocation, Software interrupts, Exception Handling.

Cortex-M4 Implementation and applications: Detailed block diagram, Bus interfaces on cortex-M4, External PPB interface, typical connections, reset types and signals. Getting started with µVision. Applications: Flashing of LEDS using Shift Register, Interfacing stepper motor, Interfacing temperature sensor, Interfacing ADC, Interfacing Real Time Clock, Interfacing of Analog Key pad

Reading:

1. Joseph Yiu, The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors, Newnes Publications; Third Edition, 2013.
2. Ata Elahi-Trever Arjeski, "ARM Assembly language with hardware experiment", Springer Int. Publishing, 2015.
3. Steve Furber , "ARM system on chip Architecture", Pearson Publications, Second Edition.
4. D. V. Hall. Microprocessors and Interfacing, TMGH. Second Edition 2006.
5. Wrox, " Professional Embedded ARM Development"
6. William hohl and Christoper Hinds, "ARM assembly language fundamentals and Techniques"CRC, Second Edition, 2015.
7. M.A. Mazidi, J.G. Mazidi, R.D. Mckinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Second Edition.