

# 19EC213 MICROCONTROLLERS

Hours Per Week :

| L | T | P | C |
|---|---|---|---|
| 3 | - | 2 | 4 |

**PREREQUISITE COURSE:** Digital System Design.

## COURSE DESCRIPTION AND OBJECTIVES:

This course introduces about microprocessor and microcontroller to the student. The course objective is to study the architecture, hardware components and software aspects of ARM LPC 2148 and Cortex M3.

## COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes.

| COs | Course Outcomes   |
|-----|---|
| 1   | Understand the evolution and architectures of ARM and ARM Cortex-M3 processors.                     |
| 2   | Program on LPC 2148 for the specific application.   |
| 3   | Understand the peripherals used with microcontroller systems.                                       |
| 4   | Compare the specifications and suitability of I2C, SPI, RTC, WATCHDOG TIMER, PWM generation blocks. |
| 5   | Develop applications and experiment to interface various peripherals to ARM Processors.             |

## SKILLS:

- ✓ Identify suitable microprocessor / microcontroller and hardware components for a specific application.
- ✓ Develop Embedded-C or Assembly language programs using LPC 2148.
- ✓ Design microcontroller based systems using LPC 2148 / Cortex-M3.
- ✓ Develop the environment for interfacing peripherals with ARM processors.



### SOURCE:

<https://positrontech.in/eshop/wp-content/uploads/2018/01/AVR-Microcontroller-Board.png>

|   |            |
|---|------------|
| <b>UNIT - I</b>   | <b>L-9</b> |
| <b>ARM ARCHITECTURE &amp; PROGRAMMING MODEL:</b> ARM design philosophy, Registers, Program status register, Instruction pipeline, Interrupt and vector table, ARM processor families, Instruction set: Data processing instructions, Addressing modes, Branch, Load-Store instructions, PSR instructions, and Conditional instructions. |            |
| <b>UNIT - II</b>  | <b>L-9</b> |
| <b>LPC 2148 CONTROLLER ARCHITECTURE :</b> Features, Architecture, Functional pin description, On-chip Flash memory, On chip SRAM, Memory Mapping, LPC 2148 programming - programming of LPC 2148 GPIO ports, generation of PWM signals, simple programs.  |            |
| <b>UNIT - III</b>   | <b>L-9</b> |
| <b>LPC 2148 COMPONENTS:</b> PLL, General purpose I/O (GPIO), ADC and DAC, Timers and counters, Watchdog timer, Real-time clock, Interrupt controller.   |            |
| <b>UNIT - IV</b>  | <b>L-9</b> |
| <b>LPC 2148 PERIPHERALS:</b> UART, USB, Features of I2C - bus serial I/O controller; SPI - serial I/O controller, pulse width modulator.  |            |
| <b>UNIT - V</b>   | <b>L-9</b> |
| <b>ARM CORTEX-M3:</b> Features, Architecture, Operation modes, NVIC, Instruction set development-thumb-2 technology and instruction set architecture; Cortex-M3 applications.   |            |

## LABORATORY EXPERIMENTS

### LIST OF EXPERIMENTS

**TOTAL HOURS: 30**

#### Simulation using LPC 2148:

1. Blinking of LED's.
2. Reading switches and glowing LED's.
3. Generation of PWM signals.

#### Interfacing with LPC 2148:

1. 7 Segment LED.
2. LCD Module.
3. 4x4 Hex keypad.
4. DC motor control.
5. Real time clock.
6. Temperature sensor.
7. Bluetooth module.
8. Wi-Fi Module.
9. Micro SD Card.

**TEXT BOOKS:**

1. Andrew N Sloss, Dominic Symes and Chris Wright, "ARM system developer's guide", Elsevier - Morgan Kaufmann Publishers, 2008.
2. Joseph Yiu, "The definitive guide to the ARM CORTEX-M3", 2<sup>nd</sup> edition, Elsevier - Newnes, 2010.

**REFERENCE BOOKS:**

1. Steve Furber, "ARM System on Chip Architecture", 2<sup>nd</sup> edition, Pearson education, 2000.
2. Martin Trevor, "The Insider's Guide to the ARM7 based microcontrollers", Hitex Ltd., 2006.
3. William Hohe and Christopher Hinds, "ARM Assembly Language", 2<sup>nd</sup> edition, CRC Press, 2015.
4. David Seal, "ARM Architecture Reference Manual", Addison-Wesley, 2001.