22UCSC402	Programming Computer Peripherals and Interfacing	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Understand the Basic architecture and Peripherals associated with Micro-processers & Micro-controllers.
- Understand the internal architecture, instruction set of ARM7 microcontroller, assembling process & implement small programs.
- Design & develop Assembly Language Program /& C program for a given real time application.
- Demonstrate working knowledge of the necessary steps and methods used to interface ARM7 to devices such as motors, LCD, ADC, and DAC etc.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the Basic architecture and Peripherals associated with Micro-processers & Micro-controllers	-	1	-
CO-2	**Explain** the features of embedded systems, architecture of ARM7 and applications.	-	1	-

CO-3	**Illustrate** the ARM and THUMB instruction sets.	-	2,5	13
CO-4	**Write** an ASM / Embedded C program using the instruction set of ARM and THUMB to solve the engineering problems.	-	3	-
CO-5	**Design** and **Write** ARM (LPC2148) program for specific applications.	-	5	3,12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mapping Level	2.0	2.0	1.5	-	2.0	-	-	-	-	-	-	1.0	1.0	-	-	-

Pre-requisites: Number systems, Digital systems and Computer Organization

Contents:

Unit-I

Introduction to Processor & Controllers: Evolution of Microprocessor, Block diagram and Features of Microprocessor & Micro-controller, Comparison of Microprocessor and Microcontroller, The RISC & CISC design philosophy. **7 Hrs**

Unit-II

Peripheral Interfacing with Microprocessor: Static and Dynamic memories, Vector interrupt table, Interrupt service routine, Interfacing of microprocessor with Programmable Interrupt Controller 8259, DMA controller 8257, Programmable peripheral Interface-8255. **9 Hrs**

Unit-III

ARM Embedded Systems and ARM Processor Fundamentals: ARM design philosophy, embedded system hardware- AMBA bus protocol, embedded system software- applications. ARM core data flow model, Registers, CPSR-Processor modes, Banked registers. Pipeline- Characteristics **7 Hrs**

Unit-IV

ARM Instruction Set: Fundamentals of ARM instructions, Barrel shifter, Classification and explanation of instructions with examples-Data processing, Branch, Load-store, SWI and Program Status. IRQ and FIQ exceptions, Comparison between exception and interrupts. Interrupt handling schemes- nested interrupt handler, non-nested interrupt handler. Basic interrupt stack design.

Introduction to THUMB and ARM Programming: Introduction to THUMB, Differences between ARM and THUMB, Register usage in Thumb, ARM Thumb Interworking. General Structure of ARM assembly module, Assembler directives. Simple ALP programs on Arithmetic & logical operations, Factorial, string operation, sorting, searching, and Scan. **8 Hrs**

Unit-V

Peripheral Interfacing: Salient features of LPC2148 ARM CPU, applications, block diagram, memory mapping. Functional features of Interrupt controller, RTC, USB, UART, I2C, SPI, SSP controllers, watch dog timers and other system control units. GPIO, PLL & Timers: Features, Register description with example and Applications. Interfacing of Stepper motor, DC Motor, LED interface. **8 Hrs**

Reference Books:

1) Ramakant A Gayakwad, "Microprocessor and Interfacing ", 4/E, Tata McGraw Hill, 2009
2) B.Ram, "Microprocessors and Interfacing",
3) Atul P Godse and Mrs. Deepali A Godse, "Microprocessors and Interfacing",
4) William Hohl, "ARM Assembly Language", CRC Press.
5) Steve Furber, ARM System-on-chip Architecture, Pearson Education, 2012
6) LPC 2148 User Manual