SEMESTER S4

COMPUTER ARCHITECTURE AND MICROCONTROLLER

Course Code	**PCMRT403**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None/ (Course code)	**Course Type**	Theory

Course Objectives:

1. To acquire basic and application knowledge of basic computer architecture
2. Understand the basic concepts and architectures of microcontrollers

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Algorithms for binary multiplication and division. Fixed and floating-point number representation. Functional units of a computer, Von Neumann and Harvard computer architectures, CISC and RISC architectures. Processor Architecture – General internal architecture, Address bus, Data bus, control bus. Register set – status register, accumulator, program counter, stack pointer, general purpose registers. Processor operation – instruction cycle, instruction fetch, instruction decode, instruction execute, timing response, instruction sequencing and execution (basic concepts, data path.	9
2	Microcontrollers and Embedded Processors. Architecture – Block diagram of 8051, Pin configuration, Registers, Internal Memory, Timers, Port Structures, Interrupts. Assembly Language Programming - Addressing Modes, Instruction set (Detailed study of 8051 instruction set is required). Simple programming examples in assembly language. Interfacing with 8051 using Assembly language programming: LED, Seven segment LED display.	11

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3	Programming in C - Declaring variables, Simple examples – delay generation, port programming, code conversion. Interfacing of – Stepper Motor, DAC and ADC -- with 8051 and its programming. 8051 Timers/Counters - Modes and Applications. Serial Data Transfer – SFRs of serial port, working, Programming the 8051 to transfer data serially.	**11**
4	Introduction to ARM - ARM family, ARM 7 register architecture. ARM programmer's model. System software - Assembler, Interpreter, Compiler, Linker, Loader, Debugger. Types of memory - RAM, ROM. Memory Characteristics and Hierarchy. Cache memory – The basics of Caches, Mapping techniques, Improving Cache performance. Virtual memory – Overlay, Memory management, Address translation. Input/Output Organization – Introduction, Synchronous vs. asynchronous I/O, Programmed I/O, Interrupt driven I/O, Direct Memory Access.	**13**

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

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Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain the functional units, I/O and memory management w.r.t a typical computer architecture.	**K2**
CO2	Distinguish between microprocessor and microcontroller.	**K2**
CO3	Develop simple programs using assembly language programming.	**K3**
CO4	Interface 8051 microcontroller with peripheral devices using ALP/Embedded C	**K3**
CO5	Familiarize system software and Advanced RISC Machine Architecture.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	2	1	1	1	1	2	1	2
CO2	3	3	1	1	2	1	1	1	1	1	1	1
CO3	3	2	2	2	3	1	1	1	1	2	1	2
CO4	3	3	3	3	3	1	1	1	2	2	2	2
CO5	3	2	2	2	3	1	1	1	1	2	1	2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

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Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The 8051 microcontroller and Embedded System	Muhammed Ali Mazidi & Janice Gilli Mazidi, R.D. Kinley	Pearson Education	2nd edition, 2007
2	Computer Architecture and Organization: From 8085 to Core2Duo and beyond	Subrata Ghoshal	Pearson	1st edition, 2011
3	ARM System - on-chip Architecture	Steve Furber	Pearson Education	2014

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Computer System Architecture	Mano M M	Prentice Hall of India	3rd Edition, 2017
2	Computer organization and design: The Hardware/Software interface	David A. Patterson, John L. Hennessy	Elsevier	6th edition. 2021
3	Computer Organisation	V. Carl Hamacher, Zvonko G. Vranesic, Safwat G.Zaky	McGraw-Hill Education	5th edition, 2017
4	8085 Microprocessor Architecture, Applications and Programming	Ramesh S Goankar	Penram International	5/e

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Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/106/105/106105163/
2	https://archive.nptel.ac.in/courses/106/105/106105163/
3	https://archive.nptel.ac.in/courses/106/105/106105163/
4	https://archive.nptel.ac.in/courses/106/105/106105163/