

<b>COURSE TITLE</b>	<b>COMPUTER ORGANIZATION AND ARCHITECTURE</b>
<b>COURSE CODE</b>	<b>01CT1301</b>
<b>COURSE CREDITS</b>	<b>4</b>

**Objective:**

- 1 To conceptualize the concepts of organizational and architectural issues of a digital computer. Further, analyze performance issues in processor and memory design of a digital computer. Also, understanding various data transfer techniques in digital computer and to analyze processor performance improvement using instruction level parallelism.

**Course Outcomes:** After completion of this course, student will be able to:

- 1 Apply knowledge of the processor's internal registers and operations by use of a PC based microprocessor simulator
- 2 Apply the knowledge of combinational and sequential logical circuits to mimic a simple computer architecture
- 3 Analyze various features of microprocessor, memory and I/O devices including concepts of system bus
- 4 Write assembly language programs and download the machine code that provides solution to real-world control problems
- 5 Analyze the importance of parallelism and stall in computer architecture

**Pre-requisite of course:**Digital Electronics

**Teaching and Examination Scheme**

<b>Theory Hours</b>	<b>Tutorial Hours</b>	<b>Practical Hours</b>	<b>ESE</b>	<b>IA</b>	<b>CSE</b>	<b>Viva</b>	<b>Term Work</b>
3	0	2	50	30	20	25	25

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Introduction to Computer Organization</b> Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory-reference instructions, input-output and interrupt, complete computer description, Machine Language, Assembly Language Programming: Arithmetic and logic operations, looping constructs	9
2	<b>Register Transfer and Micro-operations</b> Register Transfer language, Register Transfer, Bus and Memory Transfers (Tri-State Bus Buffers, Memory Transfer), Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logical shift unit	3
3	<b>Fundamentals of Micro programmed Control</b> Control Memory, Address sequencing, Micro program Example, design of control Unit	3

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
4	<b>Concepts of Central Processing Unit</b> Introduction, general register organization, stack organization, instruction format, addressing modes, data transfer and manipulation, program control, reduced instruction set computer (RISC), complex instruction set computer(CISC)	8
5	<b>Computer Arithmetic</b> Introduction, addition and subtraction, multiplication algorithms (booth multiplication algorithm), division algorithms, floating point arithmetic operations, decimal arithmetic unit	7
6	<b>Introduction to Pipeline and Vector Processing</b> Flynn's taxonomy, parallel processing, pipelining, arithmetic pipeline, instruction pipeline, RISC Pipeline, Vector Processing, Array Processors	5
7	<b>Input-Output Organization</b> Input-output interface, asynchronous data transfer, modes of transfer, DMA, input - output processor (IOP), priority interrupt, CPU IOP communication, serial communication	4
8	<b>Memory Organization</b> Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory	3
<b>Total Hours</b>		<b>42</b>

#### Suggested List of Experiments:

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Experiment-1</b> Introduction to 8085 Microprocessor Trainer board with explanation of necessary hardware connection with microprocessor	2
2	<b>Experiment-2</b> Data Transfer (Copy) Operations a. Write the data 41h into register C and copy it to Accumulator b. Load Register H with 34h and Register L with ABh. c. Copy 32h in all the Registers. d. Load accumulator with the content of memory whose address is D000h using three different techniques. e. Exchange the content of memory location D000h and D001h using direct addressing and indirect addressing.	2
3	<b>Experiment-3</b> Arithmetic Operations a. Load Register B and C with 55h and 66h. Add Register B, C and store the result in Register D. b. Add two 16-bit numbers with and without using DAD. (HL+BC and store the answer in HL) c. Add the content of memory location D000h, D001h and store the result at memory locations D040h and D041H. d. Transfer the array (3 byte) of data starting from D000h to the locations starting from D050h by memory pointer with and without LDA/STA. e. Subtract two 16-bit numbers. (HL-BC and store answer in HL)	2

### Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
4	<b>Experiment-4</b> a. Assume register B holds 93h and the accumulator holds 15h. Illustrate the result of instruction ORA B, XRA B and CMA. b. Load the data byte 8EH in register D and F7H in register E. Mask the higher order bits (D7-D4) from both the data bytes.	2
5	<b>Experiment-5</b> Write an assembly language program to generate time delay using following three different approaches. No need to generate specific delay. You can load the value of your choice. a. Using a simple Register b. Using Register Pair c. Using loop within a loop	2
6	<b>Experiment-6</b> Write an assembly language program to count from 0 to 9(modulo 10 counter) with some delay between each count. Also display the count at output port 00H. At the count of 9 the counter should reset to 0 and repeat the sequence continuously	2
7	<b>Experiment-7</b> Write an assembly language program to clear all the flag bits in flag register. Use the concept of PUSH and POP instruction to demonstrate this task. Load the accumulator with 00H. Logically OR the accumulator with itself to set zero flag and display flag bits on port 01H	2
8	<b>Experiment-8</b> Write an assembly language program to convert a BCD number into Binary. Assume any two-digit number of your choice as an input BCD number.	2
9	<b>Experiment-9</b> Write an assembly language program to convert a binary number into un-packed BCD number. (Assume any binary number available in memory).	2
10	<b>Experiment-10</b> Write an assembly language program to convert a packed BCD number into seven segment code and display. Use common cathode type seven segment display. Assume the packed BCD number is available in memory.	2
11	<b>Experiment-11</b> Write an assembly language program to multiply two 8-bit numbers stored in Register A & Register B	2
12	<b>Experiment-12</b> Write an assembly language program to divide two 8-bit numbers stored in Register A & Register B.	2
13	<b>Experiment-13</b> Write an assembly language program to find out largest number from given array stored at 5 consecutive memory locations starting from C030H and store the result to memory location C040h.	2

### Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
14	<b>Experiment-14</b> Write an assembly language program to find out smallest number from given array stored at 5 consecutive memory locations starting from C030H and store the result to memory location C040h.	2
<b>Total Hours</b>		<b>28</b>

### Textbook :

- 1 Computer System Architecture, M. Morris Mano, Pearson 3 edition, 1992
- 2 Structured Computer Organization, Andrew S. Tanenbaum and Todd Austin, PHI, 6 edition, 2016

### References:

- 1 Computer Architecture & Organization, Computer Architecture & Organization, M. Murdocca & V. Heuring, WILEY, 2007
- 2 Computer Architecture and Organization, Computer Architecture and Organization, John Hayes, McGraw Hill, 1998

### Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
20.00	20.00	30.00	15.00	10.00	5.00

### Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of the students. The teacher in addition to conventional teaching method (Chalk and Talk) may use any of the tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc. for effective teaching.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 3 Practical examination will be conducted at the end of the semester for evaluation of performance of students in laboratory.
- 4 Students may use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory, etc.
- 5 The course delivery method will depend upon the requirement of content and need of the students. The teacher in addition to conventional teaching method (Chalk and Talk) may use any of the tools such as demonstration, role play, Quiz, brainstorming, Flipped class, Project based learning, Collaborative learning, MOOCs etc. for effective teaching.

**Supplementary Resources:**

- 1 <https://www.javatpoint.com/computer-organization-and-architecture-tutorial>
- 2 <https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/>
- 3 <https://nptel.ac.in/courses/106/103/106103068/>
- 4 <https://tutorialspoint.dev/computer-science/computer-organization-and-architecture>
- 5 <https://www.studytonight.com/computer-architecture/>