

Examination	:	End Semester Examination – Nov/Dec 2024
Name of the Course	:	B.Tech. (IT & Mathematical Innovations)
Name of the Paper	:	Computer Systems Architecture (DSC-9)
Unique Paper Code	:	3122612303
Semester	:	III
Duration	:	3 hours
Maximum Marks	:	90

Instruction to students:

"Attempt any four questions, Q1 is compulsory"

1. Attempt Any 10 questions (3 x 10=30 Marks)

- a. What are the basic components of a Microprocessor?
- b. Explain the difference between Hardwired Control Unit and Microprogrammed Control Unit.
- c. What is the difference between RISC and CISC architectures? Provide examples of each.
- d. Define Computer Architecture and explain its relationship with Computer Organization.
- e. What is full adder? List the truth table of full adder and draw the logic diagram.
- f. Write an assembly language program to multiply two positive numbers by a repeated addition method. For example, to multiply 3×4 , the program evaluates the product by adding 5 four times, or $3 + 3 + 3 + 3$.
- g. Obtain the 9's complement of the 13249876 eight-digit decimal numbers.
- h. Convert the following numbers with the indicated bases to decimal and Hexadecimal : $(12221)_3$; $(11101.11)_2$ and $(460)_5$.
- i. Simplify the following expressions in sum-of-products form : $Y'Z' + YZ' + XY$.
- j. Explain three state bus buffer.
- k. Simplify the following Boolean function in product-of-sums form by means of a four-variable map. Draw the logic diagram with OR-AND gates;

$$F(w, x, y, z) = (2, 3, 5, 7, 10, 14)$$

$$d(w, x, y, z) = (4, 6, 11, 15)$$

- l. Explain why each of the following microoperations cannot be executed during a single clock pulse in the system. Specify a sequence of microoperations that will perform the operation.

(a) $IR \leftarrow M[PC]$

(b) $DR \leftarrow DR + AC$ (AC doesn't change)

2.

(2 x 10=20 Marks)

- a. What are the different types of instruction formats? Provide an example of each.
- b. What are the different types of Addressing Modes used in assembly language programming?

3.

(2 x 10=20 Marks)

- a. Explain the concept of memory hierarchy in a computer system. Discuss the different levels of memory (registers, cache, main memory, and secondary memory), and explain how they contribute to system performance.
- b. Explain the fetch-decode-execute cycle in a computer system. How does the CPU execute instructions in this cycle?

4.

(2 x 10=20 Marks)

- a. Discuss the basic structure of a computer system. Include details about the CPU, memory, I/O devices, and the role of each component in the overall functioning of the system.
- b. What is an I/O system? Discuss the different methods of I/O interfacing, including Programmed I/O, Interrupt-driven I/O, and Direct Memory Access (DMA). Compare their advantages and disadvantages.

5.

(2 x 10=20 Marks)

- a. A system uses a 16-bit address bus and a 16-bit data bus. The memory is organised in 4 banks, each 16 KB.
 - (a) How many address lines are required to address the entire memory?
 - (b) How many bits are required to represent the word length?
 - (c) If a word contains 2 bytes, how many words are there in each memory bank?
- b. Consider a hypothetical 16-bit instruction format where the first 6 bits represent the opcode, and the remaining 10 bits represent the address of the operand.
 - (a) How many distinct operations can be represented by this instruction format?
 - (b) If an instruction needs to address a memory space of 1K, how many bits are required for the address part?
 - (c) How would you modify the instruction format if the opcode is increased to 8 bits?
