

Time: 3 hrs.

Attempt any 5 questions.

Max Marks: 75

Question No.1 is compulsory.

(Write your Roll No. on the top immediately on receipt of this question paper)

1. Each part carries 3 marks.

- Explain the truth table and working of an *exclusive-NOR* gate?
- Explain the need for "Timing and Control signals" in a digital computer?
- What should be the base (or radix) of the number system such that the following equation holds:

$$[312 / 20] = [13.1]_{16}$$

- How many 128×8 memory chips are needed to provide a memory capacity of 4096×16 ?
- Differentiate between Dynamic and Static RAM? What do we mean by a Memory Address Map?

2.

- Simplify the Boolean function F together with don't care conditions d in
 - Sum-of-products form
 - Product-of-sums form

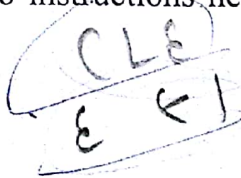
$$F(m, n, o, p) = \sum (2, 3, 5, 6, 13)$$

$$d(m, n, o, p) = \sum (1, 4, 11)$$

Compare their hardware implementations.

(8)

- Show how a 9-bit microoperation field in a microinstruction can be divided into subfields to specify 46 microoperations. How many microoperations can be specified in one microinstruction? (4)
- What are the two instructions needed in the basic computer to set the E flip-flop to 1? (3)



3.

- Design a 4-bit count-down counter and derive a sequential circuit for the same. (6)

- b. Write a program to unpack two characters from location WRD and store them in bits 0 through 7 of locations CH1 and CH2. Bits 8 through 15 should contain zeros. (5)

- c. Show the bit configuration of a 24-bit register when its content represents the decimal equivalent of 295: (4)

- in binary
- binary-coded octal
- binary-coded hexadecimal
- binary-coded decimal

4.

- a. Show how a binary counter with parallel load can be made to operate as divide-by-10 counter (i.e. a counter that counts from 0 to 10 and back to 0)? (7)

- b. A composite Adder-Subtractor circuit has the following values of mode M and data inputs A and B. In each case, determine the values of the outputs: S_3, S_2, S_1, S_0 and C_4 (5)

Mode

M	A	B
0	0111	0110
0	1000	1001
1	1100	1000
1	0101	1010
1	0000	0001

- c. Obtain the 5's and 4's complement of the following numbers: (3)

i. $(132231)_5$ 312213 312214

ii. $(100001)_5$ 344443 344444

iii. $(444444)_5$ 111111 111112

- a. Write an assembly program that evaluates the logic *exclusive-NOR* of two logic operands? (5)

- b. Design a digital circuit that performs the four logic operations of *exclusive-OR*, *exclusive-NOR*, *NOR*, and *NAND*. Use two selection variables. Show the logic diagram of one typical stage. (5)

- c. What is an interrupt procedure? Explain the differences between interrupt procedure and a sub-routine call? (5)

6.

- a. A computer has 16 registers, an ALU with 32 operations, and a shifter with 8 operations, all connected to a common bus system. (5)
- Formulate a control word for a microoperation
 - Specify the number of bits in each field of the control word and give a general encoding scheme
 - Show the bits of the control word that specify the microoperation $R4 \leftarrow R5 + R6$

- b. List and discuss the sequence of microoperations executed during the instruction cycle of ISZ (Increment and Skip if Zero) computer instruction. (5)

- c. The 16-bit 2's complement representation of an integer is

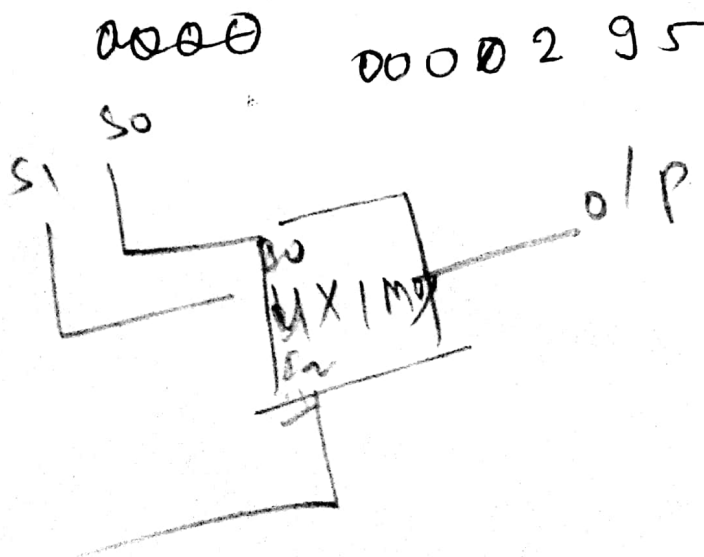
1111 1111 1111 0101

What is its decimal representation?

(3)

- d. Which is the smallest integer that can be represented by an 8-bit number in 2's complement form? (2)

2 9 5
 0000 0010 1001 0101
 0000 1225



1111 1111