10/5/22 Morning

[This question paper contains 6 printed pages.] 1

Your Roll No.....

Sr. No. of Question Paper : 1401 A

Unique Paper Code : 42344403

Name of the Paper : Computer System Architecture

Name of the Course : **B.Sc. (Prog) / Mathematical Science**

Semester : IV

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. **1** is compulsory.
3. Attempt any **5** of questions Nos. **2** to **9**.
4. Parts of a question must be answered together.

1. (a) How many 256 words x 8 bits per word RAM chips are needed to provide a memory capacity of 4096 words x 16 bits per word? (2)

P.T.O.

(b) What is radix of the numbers if the solution to the quadratic equation (2)

$x^2 - 10x + 31 = 0$ is $x = 5$ and $x = 8$?

(c) Represent the following conditional control statement by two register transfer statements with control functions.

If $(P = 1)$ then $(R1 \leftarrow R2)$ else if $(Q = 1)$ then $(R1 \leftarrow R3)$ (2)

(d) State any two differences between combinational and sequential circuit. (2)

(e) Give the characteristic table of JK flip-flop. (2)

(f) What is a binary counter? How many flip-flops will be required for an n-bit binary counter? (2)

(g) Consider a memory of capacity 16M words x 32 bits per word. How many address lines and input-output data lines are needed? (2)

(h) Simplify the following expressions using Boolean algebra.

(BC'+A'D) (AB'+CD') (2)

(i) Can the following microoperation be executed during a single clock pulse in the system? Specify a sequence of microoperations that will perform the operation

$IR \leftarrow M[PC]$ (2)

(j) How many flip-flops will be complemented in an 8-bit counter to reach the next count after :

(i) 01100111

(ii) 11111111 (2)

(k) Convert the following decimal numbers to the base indicated

(i) 7562 to octal

(ii) 1938 to hexadecimal (2)

(l) Write a short note on input-output interface. (3)

2. (a) Define the full adder. Illustrate same with the help of truth table and logic diagram. Also write Boolean expression for carry and sum operations. (6)

(b) Given two registers A and B with contents as follow –

Register A (before operation) 1010

Register B (logic operand) 1100

Show the contents of A using the contents of B after performing the following operations.

(i) Mask operation

(ii) Selective Complement (4)

3. (a) Design a 4-bit combinational circuit decrementer using four full-adder circuit. Explain its working. (6)

(b) Simplify the given Boolean function using four-variable maps. [Sum of the Products (SOP) form.]

$F(A, B, C, D) = \Sigma(0,2,4,5,6,7,8,10,13,15)$. (4)

4. (a) An instruction is stored at location 300 with its address field at location 301. The address field has the value 400. A processor register R1 contains the number 200. Evaluate the effective address if the addressing mode of the instruction is

(i) immediate

(ii) relative

(iii) index with R1 as the index register. (6)

(b) Explain the concept of Direct Memory Access using block diagram? How does DMA transfer take place? (4)

5. (a) What are the different types of instruction formats?

Given the following instructions (in hexadecimal), identify the category to which each of these belong.

(i) F800

(ii) 7800 (6)

(b) Design a 3x8 decoder using 2x4 decoders. Explain its working. (4)

6. (a) Write a program to evaluate the arithmetic statement :

$$X = (A+B) * (C+D)$$

using zero address and one address instructions. (6)

(b) What is hardwired control unit? Explain its working with a suitable diagram. (4)

P.T.O.

7. (a) List phases of the instruction cycle. Draw flowchart of the instruction cycle. (6)

   (b) How can an effective address be determined using direct and indirect address instructions? How many references to memory are needed for each type of instruction to bring the operand into a processor register? (4)

8. (a) The content of AC in the basic computer is hexadecimal B675 and the initial value of E is 1. Determine the contents of AC, PC, AR and IR in hexadecimal after the execution of CMA instruction (7200). The initial value of PC is hexadecimal 072. (6)

   (b) What is the difference between isolated I/O and memory-mapped I/O? What are the advantages and disadvantages of each? (4)

9. (a) Write short notes on the following :–

   (i) BSA and BUN

   (ii) Types of ROM (6)

   (b) Explain the working of a 4-to-1 MUX with a suitable diagram. (4)