[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5726 **L**

Unique Paper Code : 2344000023

Name of the Paper : Computer System Architecture

Name of the Course : **Generic Elective**

Semester : II

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question No. **1** in **Section-A** is compulsory.
3. Attempt **any 4** questions from among questions **2** to **7** in **Section-B**.
4. Parts of a question must be answered together.

Section- A

1. a) State whether the following instructions are register reference, memory reference or input-output type: 3

   i) CLA ii) BSA iii) SKI iv) ISZ v) INP vi) HLT

   b) Give any two examples of sequential circuits and combinational circuits. Which digital circuit will be used to perform binary addition and subtraction both on 4-bit data? 3

   c) Give the name and size of the register for each of the following tasks: 3

   i) This register holds the address of the data or instruction present in the main memory

   ii) The instruction when fetched from the main memory, will be transferred to this register.

   iii) This register is used to hold the data temporarily.

   d) What is the range of unsigned numbers that can be accommodated in a n-bit register? And thus calculate the range of unsigned numbers that can be accommodated in 5-bit register. 3

P.T.O.

e) Represent $(-12)_{10}$ in the following representations, assuming that data is stored in 6-bit register: 3

i) Signed-magnitude representation

ii) 1's complement representation

iii) 2's complement representation

f) Describe the following addressing modes with examples: 3

i) Immediate addressing mode

ii) Implied addressing mode

g) Give the space time diagram for the execution of 7 tasks in a 4-stage pipeline computer. 3

h) Frame the micro-instruction that is represented by the following control word 3

010	011	001	00101

given that opcode given in the control word represent addition operation.

i) Prove the following identity using the truth table: 3

$xy' + x'y = x \oplus y$

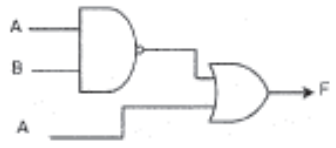
j) Perform the following conversions: 3

i) $(240.125)_{10}$ to $(\ ?\ )_5$

ii) $(476)_{16}$ to $(\ ?\ )_{10}$

Section- B

2. (a) Give the Boolean expression for the following logic diagram and obtain the simplified Boolean expression for the same. 5



(b) Give the graphic-symbol, the characteristic table and the excitation tables for: 5

i) D-Flip-flop

ii) SR- Flip-flop

(c) What is meant by GPU? List any four characteristics of GPU.

3. (a) Explain the significance of DMA and the various modes of data transfer in DMA. 5

(b) Give the truth table of a four-input and two-output encoder. Also draw the logic diagram. 5

c) Give the micro-operations required to execute the following machine instruction: 5

i) ISZ ii) BUN

Q4 (a) Explain read-only memory with the help of the block diagram. Draw the block diagram of 256 x 16 ROM. How is it different from RAM? 5

b) Obtain the simplified expression for the following Boolean function 5

$F(A, B, C, D) = \Sigma(3, 7, 11, 13, 14, 15)$

using four-variable K-map in :

i) Product-of-Sums form

ii) Sum-of-Products form

(c) Draw the diagram representing communication of the processor with the peripheral devices through the I/O buses. What is the purpose of the status command issued by the processor to any I/O interface? 5

Q5 (a) A processor has a 5-stage instruction pipeline. each stage takes 2 ns to complete. The processor needs to execute 100 instructions. Calculate the total execution time with pipelining and thus the Speedup achieved due to pipelining. 5

b) Assuming that the negative numbers are represented using 2's complement representation, perform the binary addition on 1110 and 1101 using 4-bit register. and thus detect the overflow, if any. 5

c) Give any three characteristics of RISC computers. How is it different from CISC computers? 5

Q6 a) An instruction at address 021 in the basic computer has I=1, an operation code (3-bit) specifying the load operation, and an address part equal to 083 (all numbers are in hexadecimal). The memory word at address 083 contains B8F2 and the content of AC is **A937** and answer the following: 7

i) What will be the instruction (in hexadecimal) that will be fetched from the memory?

ii) Go over the instruction cycle and determine the contents of the following registers: PC, AR, DR, AC and IR at the end of each timing signal starting from T_0 to the end of execute cycle.

b) Demonstrate the Instruction-cycle of the basic computer with the help of a flowchart. 8

Q7 a) Assume that the following 8-bit registers R_1, R_2, R_3 and R_4, initially have the following unsigned values: 7

R_1=1111 0011, R_2=1110 0011, R_3=0011 1010, R_4=1010 1010

Determine the 8-bit values in each register after the execution of the following micro-operations in sequential manner:

$T_1 : R_2 \leftarrow \overline{R_1} \wedge R_3$

$T_2 : R_4 \leftarrow (R_3 \vee \overline{R_2}) \wedge R_4$

b) What do you understand by hardwired and micro-programmed control unit organization? Draw the block diagram of the hardwired control unit of basic computer. 8