Note: Question No. 1 is Compulsory. Select four questions in all, one question from each unit.

Compulsory Question:

1. (i) What is the difference between hardwired organization and microprogram organization? 
(ii) How do you identify whether the instruction is memory reference or register reference or I/O instruction? 
(iii) What is the difference between micro-operation and macro-operation? 
(iv) What is the difference between external and internal interrupts?

UNIT-I

2. (i) Explain the common bus system? How the data is manipulated? 
(ii) Explain the different memory reference instructions?
3. (i) Design the block diagram of control unit of a computer? Also draw Timing diagram. (6)
(ii) What are the two instructions needed in the basic computer in order to set the E flip-flop to 1? (2)

UNIT-II

4. (i) Design an arithmetic circuit with one selection variable\( S \) and two \( n \) bit data inputs A and B. Draw the logic diagram for the first two stages.

\[
\begin{array}{c|c|c}
S & C_{in} = 0 & C_{in} = 1 \\
0 & D = A + B \text{ (add)} & D = A + 1 \text{ (increment)} \\
1 & D = A - 1 \text{ (decrement)} & D' = A + B + 1 \text{ (subtract)}
\end{array}
\]

(3)

(ii) Explain different types of shift micro-operations? (3)

5. (i) Draw and explain the bus system using three state buffer and a decoder instead of multiplexers and also show the connection to transfer the data from register A to register C. There are 4 registers of 4 bits each. (5)

(ii) Explain hardware implementation of logic micro-operations? (3)

UNIT-III

6. (i) Write a note on the following:
(a) Control memory. (2)
(b) Microinstruction. (1)
(c) Microprogram. (1)
(ii) The control memory has 4096 words of 24 bits each.
(a) How many bits are there in control address register? (1)
(b) How many bits are there in each of four input going to multiplexer? (1)
(c) What are the number of inputs in each multiplexer and how many multiplexers are needed? (2)

7. Write a note on microprogram sequences? (8)

UNIT-IV

8. Explain various addressing modes with example? (8)

9. (i) What are the various program control instructions? (6)

(ii) A computer has 32 bit instructions and 12 bit addresses. If there are 250 two address instructions, how many one address instructions can be formulated? (2)