(2½ Hours)   **Total Marks 75**

NOTE: 1) All questions are compulsory.
                   2) Figures to the right indicate full marks.
                   3) Illustrations, in-depth answers and diagrams will be appreciated.
                   4) Mixing of sub-questions is not allowed.

1. 1) Attempt All Questions.   **15**
  a) Multiple Choice Questions.
    i)   The decoded instruction is stored in ___.
           a) IR   b) PC   c) Registers   d) MDR
    ii)   ___ is used to store data in registers.
           a) D Flip-flop   b) JK Flip-flop
           c) RS Flip-flop   d) Noen of these
    iii)   ANSI stands for ___.
           a) American National Standards Institute
           b) American National Standard Interface
           c) American Network Standard Interfacing
           d) Amercian Network Security Interrupt
    iv)   The instruction, Add #45, R1 does ___.
           a) Adds the value of 45 to the address of R1 and stores 45 in that address.
           b) Adds 45 to the value of R1 and stores it in R1.
           c) Finds the memory location 45 and adds that content that of R1.
           d) None of these.
    v)   The addressing mode which uses the PC instead of a general purpose registere
           is ___.
           a) Indexed with offset   b) Relative
           c) direct   d) Both a) and c)

  b) Fill in the blanks (Attempt all)
    i)   Flip-flop is a basic element of ___ circuits.
    ii)   The Minimum number of selection inputs requred for selecting on out of 32
           inpute are ___.
    iii)   Race condition may exist in ___ sequential circuits.
    iv)   When 1101 is used to divide 100010010 the remainder is ___.
    v)   The usual BUS structure used to connect the I/o devices is ___.

TURN OVER

c) Short Answers (Attemtp all)
- i) What are shift registers?
- ii) Design NOR gate using AND, OR, NOT gates.
- iii) Define SOP and POS terms.
- iv) How instructions of typical microprocessors are classified?
- v) What are uses of interrupts?

2. Attempt the following (Any Three):   **15**
- a) With the help of neat diagram explain basic functional units of a computer.
- b) How the memory and the processor can be connected? Explain with diagram.
- c) Perform with 2's complement arithmetic: -34+22
- d) List and explain in brief main features of fourth generation computers.
- e) List the stemps needed to execute the machine instruction. Load R2, LOC
- f) Design half-adder circuit.

3. Attempt the follwing (Any Three) :   **15**
- a) Explain Big - Endian and Little - Endian Assignments.
- b) What are addressing modes? Why different addressign modes are required? Explain different RISC - type addressing modes.
- c) Compare RISC and CISC instruction sets.
- d) A typical computer must support instructions capable of performing four types of operations. List and explain these operations with at least one instruction.
- e) What is an assembler? What is object program?
- f) Consider instruction:

$$C \leftarrow [A]+[B]$$

With neat figure show a possible program segment for this task as it appears in the memory of a computer.

4. Attempt the following (Any Three) :   **15**
- a) List and explain with neat diagram main hardware components of processor.
- b) Consider the RISC Style Load instructin

      Load RS, x(R7)

Examine the actions involved in fetching and executing the above instruction.
- c) Explain with neat diagram conceptual view of the hardware needed for computation.

TURN OVER

d) Explain 5-stage organization with neat figure. What is Datapath?

e) Explain with example sequence of actions needed to fetch and execute an unconditional branch instruction.

f) How the processor generates the control signals that cause these actions to take place in the correct sequence and at the right time?

5. Attempt the following (Any Three) :   **15**

a) Convert the following pairs of decimal numbers to 5-bit 2's-complement numbers, and then perform addition and substraction an each pair. Indicate whether or not overflow occurs for each case.

     (a)   7 and 13   (b)   -12 and 9

b) Write a RISC - Style Program for computing the dot product of two vecotrs.

c) Derive the logic expressions for a circuit that compares two unsigned numbers: $X=X_2X_1X_0$ and $Y=Y_2Y_1Y_0$ and generates three outputs = XGY, XEY, and XLY. One of these outputs is set to 1 to indicate that X is greater than, equal to, or less than Y, respectively.

d) Design full adder circuit.

e) What is multiplexer? What is their need? Design 4:1 multiplexer.

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