

Full Marks: 25

Time: 1 hour

Section A

Part 1: Please answer any 2 questions. Each question carries 5 marks.

1. a) If 4 and 8 are the roots of the quadratic equation $x^2 - ax + 29 = 0$, find the radix of the system, when $a = 11$. [2.0]
b) What is normalization in floating-point representation? [1.0]
c) Convert the decimal floating point number -12.125 into hexadecimal number using IEEE-754 32 bit format. [2.0]
2. a) A computer has a memory unit with 256128 words of 32 bits each. An instruction code is stored in one word of memory. The instruction has 4 parts: an addressing mode bit, an operation code, a register code to select one of 64 registers, and an address part.
 - i) Show the calculation for number of bits in operation code, register code part and address part? [1.5]
 - ii) Draw the instruction word format and indicate bit numbering in each part. [1.5]b) What are the instructions to set E flip-flop value to 1? [2.0]
3. a) Which problems are resolved by division-overflow condition? [2.0]
b) Draw a block diagram of a control unit for a computer which has a 3-bit sequence counter (SC) and a memory unit with 3232 words. Each word is 16 bits. [3.0]
4. a) For a computer that has a memory unit with 3216 words of 16 bits each and opcode of 3 bits, show the block diagrams for different types of instruction formats with number of bits for each part. [3.0]
b) Explain instruction cycle. [2.0]

Part 2: Please answer any 3 questions. Each question carries 1 mark.

5. The unit which decodes and translates each instruction and generates necessary signals for ALU and other units, is called:
 - i) ALU
 - ii) Logical unit
 - iii) Control unit
 - iv) CPU
6. Which register is used to keep track of address of the memory location where next instruction is located?
 - i) Instruction Register
 - ii) Data Register
 - iii) Program Counter
 - iv) Address Register

7. In binary division using signed magnitude system, if the dividend is $(11100)_2$ and the divisor is $(10011)_2$, then the quotient is:
- $(00100)_2$
 - $(01100)_2$
 - $(11001)_2$
 - $(10100)_2$
8. If the value, $V(x)$ of the target operand is contained in the address field itself, the addressing mode is:
- Indirect
 - Direct
 - Immediate
 - Implied
9. The bulk of the binary information in digital computer is stored in memory, but all computations are done in:
- Processor Register
 - ALU
 - Control unit
 - Memory Register

Section – B

Part 1: Answer any four of the following:

$$4 \times 1 = 4$$

1. In parts of the processor, adders are used to calculate

- Addresses
- Table indices
- Increment and decrement operators
- All of the Mentioned

2. Controlled inverter is also known as

- Controlled buffer
- NOT gate
- Both controlled buffer and NOT gate
- None of the Mentioned

3. Which of the following flip-flops is free from race around problem?

- J-K flip-flop
- SR flip-flop
- Master-Slave Flip-flop
- None of the Mentioned

4. Whose operations are more faster among the following?

- Combinational circuits
- Sequential circuits
- Latches
- Flip-flops

5. For 8-bit input encoder how many combinations are possible?

- 8

- b) 2^8
- c) $\log(2^8)$
- d) $2^{\log 8}$

Part 2: Answer any two of the following:

$$4 \times 2 = 8$$

1. Implement the logic function $F(A,B,C,D) = \sum m(3,5,6,7,14,15)$ using a (8-to-1)MUX. 4

2. a. Explain how a decoder can be used to implement any logic function. 2
 b. Implement the logic function $F(A,B,C) = \prod m(3,5,6,7)$ using a decoder. 2

3. a. Build a JK flipflop using SR flipflop. Draw its circuit diagram and truth table. 2
 b. Describe race around condition of JK flip flop. 2

4. Draw the general register organization of mano machine (Basic computer) which contains seven registers R1 to R7, the ALU unit and MUX as required. Briefly explain it. 4