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B.C.A. IInd Semester Examination, 2023

DIGITAL ELECTRONICS AND COMPUTER ORGANIZATION

Paper : BCA–203

Time : 3 Hours] [*M.M. : 70*

Note :– Answer any *five* questions. All questions carry equal marks.

1. What are the various methods of signed number representation ? Explain in detail. Subtract the following numbers using 1's and 2's complement representation :

   (i) $(-48)_{10} + (25)_{10}$

   (ii) $(17)_{10} - (12)_{10}$

2. Write and explain all the theorems of Boolean algebra. Define canonical and standard forms of Boolean functions. Simplify the Boolean function using the don't care conditions in (i) sum of products and (ii) product of sums :

   $$F = w'(x'y + x'y' + xyz) + x'z'(y + w)$$

   $$d = w'x\,(y'z + yz') + wyz$$

3. Minimize the following four variable logic functions using *k*-map :

   (i) $F(ABCD) = \Sigma(0, 1, 2, 3, 7, 8, 9, 10, 11, 12, 13)$

   (ii) $F(ABCD) = \Sigma m(1, 3, 5, 8, 9, 10, 11, 15) + d(2, 13)$

4. Differentiate combinational circuits and sequential circuits. Write the steps of designing a combinational logic circuit. Design a combinational logic circuit that has four input and one output. The output produces one when an input is greater than 1000.

5. Differentiate lathes and flip-flops. Explain S-R flip-flop and T flip-flop using truth table and excitation table. Draw the block diagram of flip-flop conversion. Also convert the following :

   (i) R-S flip-flop to D-flip-flop

   (ii) D flip-flop to T flip-flop

6. Explain universal shift register. Write the definition for state table, state diagram and state equations. Design a sequential circuit with two D-flip-flop A and B and one input x. When $x = 0$, the state of circuit remains same. When $x = 1$, the circuit passes through the state transitions from 00 to 01 to 11 to 10 back to 00 and repeats.

7. Draw the block diagram of functional units of digital computer. Explain each block in detail.

   Define buses and their role in any system. Explain different types of buses with suitable example and diagram.

8. Explain the Booth's algorithm in detail with the help of flowchart. Using Booth's algorithm multiply the following :

   –13 by + 11

9. What do you mean by modes of transfer ? Differentiate between synchronous and asynchronous transmission. Write a short note on Direct Memory Access (DMA). Why read and write control lines in a DMA controller are bidirectional ?

10. Classify memories on the basis of principle of operation, mode of access and fabrication technology. Distinguish between volatile and non-volatile memories. Explain in detail memory hierarchy with examples and write short notes on the following :

    (i) Cache memory

    (ii) ROM