Total No. of printed pages = 6

CAI-303/DC/3rd Sem/2019

DIGITAL CIRCUITS

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Instructions :

1. Questions on PART – A are compulsory.
2. Answer any *five* questions from PART – B.

1. Fill in the blanks : 1×10=10

   (a) The binary number that come immediately after $(11111)_2$ is ———.

   (b) The octal number that come immediately after $(777)_8$ is ———.

   (c) The hexadecimal equivalent of $(100011)_2$ is ———.

   (d) BCD equivalent of decimal number $(199)_{10}$ is ———.

[Turn over

(e) NOT gate is also called as ——.

(f) NAND and NOR are called as ——.

(g) A half-adder has —— number of inputs.

(h) The number of output lines of a Decoder with "n" input lines is ——.

(i) Number of full-adders required to build a 4-bit binary adder is ——.

(j) "T" in T-flip-flop stands for ——.

2. Write true or false : 1×10=10

(a) The Gray code equivalent of $(1111)_2$ is 1001.

(b) The binary code of letter "A" in ASCII code is $(01000001)_2$.

(c) Adding 2's complement of a binary number X to another binary number Y yields Y-X.

(d) The output of Ex-NOR gate is HIGH when both inputs are similar.

(e) Ex-OR gate can be used to implement a NOT gate.

(f) A half-adder and a half-subtractor require same number of gates.

(g) In Boolean Algebra, X+X=2X.

(h) In a 3-variable Boolean Expression, a group of four 1's in the corresponding K-Map will yield a term having 2 literals.

(i) D flip-flop can be constructed using J-K flip-flop.

(j) A modulo-10 counter needs 4 flip-flops.

3. Choose the correct answer : 1×5=5

(a) Binary equivalent of Gray code 110011 is

(i) 100111 (ii) 100010

(iii) 101010 (iv) 100100

(b) $(99)_{16} + (01)_{16}$ is

(i) $(100)_{16}$ (ii) $(9A)_{16}$

(iii) $(10A)_{16}$ (iv) None of these.

(c) One of the inputs of a two-input NAND gate is permanently tied to logic '0'. The output will be

(i) 0

(ii) independent of other input

(iii) dependent on other input

(iv) at HIGH impedance

(d) The dual of the expression (A + B) is

(i) (A.B) (ii) $\overline{A.B}$

(iii) $\left(\overline{A}.\overline{B}\right)$ (iv) None of these

(e) A multiplexer has "m" select lines and "n" input lines, then

(i) $m = 2^n$ (ii) $m = n$

(iii) $m = \log_2(n)$ (iv) None of these.

PART – B

Marks – 45

4. (a) Perform the following operations using 8-bit 2's complement arithmetic 4

(i) $(45)_{10} - (20)_{10}$

(ii) $(15)_{10} - (24)_{10}$

(b) Perform BCD addition 4

(i) $(242)_{10} + (216)_{10}$

(ii) $(489)_{10} + (275)_{10}$

(c) What is ASCII code ? 1

5. (a) Minimize using Boolean Algebra theorems : 4

(i) $A.\overline{B}.\overline{C} + \overline{A}.B.C + A.B.C + A.\overline{C}$

(ii) $\left(A+\overline{B}+C\right).(A+B+C).(A+B+C).$

$\left(\overline{A}+B+C\right)$

(b) Minimize using K-map technique

$F(A,B,C,D) = \Sigma m\,(0,1,2,3,8,9,12,13,15) + \Phi(7)$ 5

6. A digital circuit has four input lines and output lines, such that the output goes HIGH whenever the two or more input lines get HIGH inputs. Determine the truth table, simplified output expression and draw the logic circuit using basic gates. 9

7. (a) Explain the working of a full adder circuit with the help of its truth table and logic diagram. 6

(b) Full adders can be used to design full subtractor. Explain. 3

8. Design a 2-bit magnitude comparator circuit. 9

9. (a) Implement the Boolean function F(A, B) = $\Sigma(1, 2)$ with a 4:1 MUX. 4

(b) Draw the block diagram of a 3-to-8 line decoder and draw its truth table. 5

10. (a) Differentiate between Combinational and Sequential Circuits. 2

(b) Draw the diagram of an R-S flip-flop with NAND gates and write its characteristic table. 7

11. Explain the working of asynchronous ripple counter. 9