Total No. of printed pages = 4

19/3rd Sem/DIE304

2021

DIGITAL ELECTRONICS

Full Marks – 100

Time – Three hours

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

Answer any *five* questions.

1. (a) Convert the following numbers : 2×5=10

   (i) $(78)_{10}$ to Octal

   (ii) $(45)_{8}$ to Binary

   (iii) $(10010110)_{2}$ to Decimal

   (iv) $(324)_{16}$ to Binary

   (v) $(24.25)_{10}$ to BCD.

   (b) Perform the following operations using 8-bit 2's complement technique : 2+2=4

   (i) $(+14)_{10} + (-12)_{10}$

   (ii) $(-21)_{10} + (-35)_{10}$.

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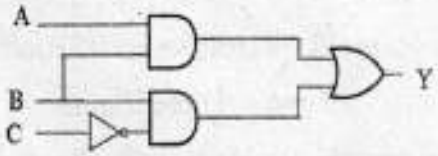
(c) Convert the following binary codes into equivalent Gray codes : 2+2=4

(i) $(110110)_2$ (ii) $(111110)_2$.

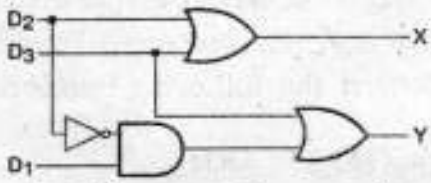
(d) Implement a NOT gate using an EX-OR gate. 2

2. (a)



For the diagram above, write its output expression and find out the truth table. 4

(b)



For the diagram above, write the output expressions for X and Y, and find out the truth tables for both X and Y. 3+3=6

(c) What do you mean by the term "Universal gates" ? 2

(d) For the Boolean expressions given below, find out the truth table and draw the logic circuit using basic gates : 4+4=8

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

(ii) $Y = \overline{A}.B + \overline{B}.C$

3. (a) Minimize the following Boolean Expressions : 2+2=4

(i) $Y = \overline{A}BC + ABC + A\overline{B}C + ABC$

(ii) $Y = (A+B+\overline{C})\,(A+B+C)\,(\overline{A}+B+C)$.

(b) Prove that : 2×3=6

(i) $X.(X+Y) = X$ (ii) $(\overline{X}+Y).Y = X.Y$

(iii) $(A+B).(A+\overline{B}) = A$.

(c) State and prove De-Morgan's theorems. 6

(d) Write the dual and complement of the following Boolean expressions : 2+2=4

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

4. (a) Minimize using K-Map technique : 4+6=10

(i) $F(A,B,C) = m(0,1,2,6) + d(3,7)$

(ii) $F(A,B,C,D) = m(4,5,6,7,12,13,14,15) + d(0,1,11)$

(b) Explain the working of a half-adder circuit with the help of its truth table and logic diagram. 4

(c) What is a full subtractor ? Write its truth table, output expressions and draw the logic diagram. 6

5. (a) Explain the working of a 4-bit binary adder with proper block diagram. 6

(b) What is a multiplexer ? Explain the working of a 4:1 Mux. 6

(c) Write the truth table of a 3-to-8 line Decoder and explain its working. 4

(d) What is a parity generator circuit ? Name the different types and briefly explain its use. 4

6. (a) Mention two differences between a Combinational circuits and Sequential circuits. 2

(b) Draw the logic circuit of an Active HIGH S-R Latch and write its characteristic equation. 6

(c) What are Programmable Logic devices ? Name the different types. 4

(d) Implement a Full-adder circuit with the help of a PLA. 8