*Total number of printed pages:*3

D/3rd/DIE304

2021

DIGITAL ELECTRONICS

Full Marks: 100

Time: Three hours

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

Answer all five questions.

1. a) Convert the following numbers into equivalent binary- 5 x 2 = 10

   i) $(78)_{10}$ ii) $(45)_8$ iii) $(2A)_{16}$ iv) $(324)_{BCD}$
   v) $(24.25)_{10}$

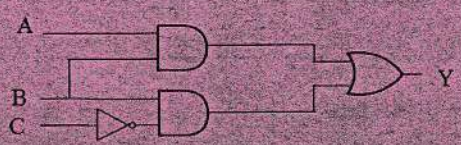
   b) Perform the following operations using 2's complement technique. 3 + 3 = 6

   i) $(+15)_{10} - (+12)_{10}$ ii) $(21)_{10} - (35)_{10}$

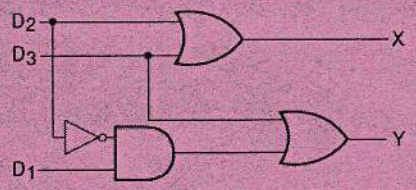
   c) Convert the following binary codes into equivalent Gray codes- 2 + 2 = 4

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

2. a) 5



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

b) 

3 + 3 = 6

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

c) For the Boolean expressions given below, find out the truth table and draw the logic circuit using basic gates. 4 + 5 = 9

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

3. a) Minimize the following Boolean Expressions- 3 + 3 = 6

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- 3 + 3 = 6

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

c) State De-Morgan's theorem- 4

d) Write the dual 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) $F(A,B,C) = m(0,1,2,3) + d(7)$

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

b) A digital circuit has three input lines and one output line. The output goes HIGH whenever the circuit gets HIGH signal to any two or more input lines. Determine the truth table, the output expression and draw the logic diagram using as minimum number of gates as possible. 8

c) Name the "Universal gates" and state why these gates are called Universal. 2

5. a) Explain the working of a half-adder circuit with the help of its truth table and logic diagram. 5

b) What is a full subtractor? Write its truth table, output expressions and draw the logic diagram. 8

c) Explain the working of a 4-bit binary adder with proper block diagram. 7