53 (IT 303) DGLD

2019

DIGITAL LOGIC DESIGN

Paper : IT 303

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 : 1×6=6

   (i) $(155)_{10} = (?)_8$

   (ii) $(11011{\cdot}101)_2 = (?)_{10}$

   (iii) $(0{\cdot}75)_{10} = (?)_2$

   (iv) $(1F\ 2B)_{16} = (?)_8$

   (v) $(1F{\cdot}1)_{16} = (?)_{10}$

   (vi) $(21{\cdot}7)_8 = (?)_2$

Contd.

(b) Use the Boolean algebra to simplify the following Boolean equation : 2×5=10

(i) $f(x, y, z) = x'yz + xy'z' + x'y'z + xyz + x'y'z'$

(ii) $f(x, y, z) = (x + \bar{x})(y + \bar{y}) \cdot (z \cdot \bar{z})$

(iii) $f(a, b) = \overline{\left(\overline{a + b}\right)} \cdot (\bar{a} \cdot b)$

(iv) $f(a, b, c) = (a + ab)\, a + a + \bar{a}bc$

(v) $f(A, B, C) = A \cdot B \cdot C + \bar{A} + A\bar{B}C$

(c) Verify by the truth table method : 2+2=4

(i) $A + \bar{A}B + AB = A + B$

(ii) $(A + \bar{B})(\bar{A} + B) = AB + \bar{A}\bar{B}$

2. (a) State and prove De-Morgan's theorem. 6

(b) Why NAND and NOR gates are called universal gate ? 2

(c) Using Boolean algebra prove that : 3×4=12

(i) $\overline{(a + b + c)} = \bar{a} \cdot \bar{b} \cdot \bar{c}$

(ii) $\left(\overline{\overline{AB} + \bar{A} + AB}\right) = 0$

(iii) $AB + A\bar{B}C + B\bar{C} = AC + B\bar{C}$

(iv) $(A + B)(A + C) = A + BC$

3. (a) Expand $\bar{A} + \bar{B}$ to minterms and maxterms. 6

(b) Using k-map simplify the following functions : 4+4=8

(i) $F(A, B, C, D) = \Sigma m(4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15)$

(ii) $F(A, B, C, D) = \Sigma m(0, 2, 5, 9, 15) + d(6, 7, 8, 10, 12, 13)$

(c) Draw the logic circuit of the Boolean function given below using basic gates : 2×3=6

(i) $Y = a'b' + (c + d)\,a$

(ii) $Y = a + b'c + d'e(f + g)$

(iii) $Y = \overline{ab} + \overline{cd} + (a + \overline{b})\,c$

4. (a) Differentiate between sequential and combinational logic circuits. 3

(b) What do you mean by don't care conditions and how don't care conditions help to simplify Boolean function using *k*-map method ? 1+2=3

(c) Design a full adder circuit. 5

(d) Write down the function table of a 8 : 1 multiplexer. 4

(e) What is race around condition ? 2

(f) Distinguish between Encoder and Decoder. 3

5. (a) Design a 1 : 8 De-multiplexer. 5

(b) Write down the Excitation tables for J-K flip-flop, D-flip-flop and S-R flip-flop. 6

(c) Design a 3 : 8 Decoder circuit and write the truth table. 7

(d) Draw the logic diagram of a D-latch. 2

6. (a) Explain the full substractor circuit. 4

(b) Implement the Boolean function using a 4 : 1 MUX :

$F(A, B, C) = \overline{A}C + A\overline{B}C + AB\overline{C}$ 4

(c) Differentiate between : 2×6=12

(i) Synchronous and asynchronous circuits

(ii) D-Latch and D-flip-flop

(iii) Minterms and Maxterms

(iv) ROM and PROM

(v) Static RAM and Dynamic RAM

(vi) MUX and De-MUX.

7. (a) Codeward received = 1011011. Assume even parity is used. State whether the received codeword is correct or wrong. If wrong, locate the bit in error. 5

(b) How does a J-K flip-flop differ from an S-R flip-flop in its operation ? 2

(c) Perform the following operation using 2's complement arithmetic : 2+2=4

(i) (+ 37) + (– 18)

(ii) (+ 24) + (– 14)

(d) Use only NAND gate to realize AND function. 3

(e) How is excitation table different from that truth table ? 2

(f) Write a short note on even parity and odd parity. Give example of each type. 2

(g) State the prove distributive law using Boolean algebra. 2
