53 (IT 303) DGEL

2017

DIGITAL ELECTRONICS

Paper : IT 303 (Back)

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 into binary : 3

   (i) $(10F)_{16}$

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

   (iii) $(321)_8$

   (b) Convert the following into decimal : 3

   (i) $(10111)_2$

(ii) $(F1)_{16}$

(iii) $(21)_8$

(c) Find out the Ex-3 code and BCD code of 23. 2

(d) Draw the logic circuit represented by each expression : 3+3=6

(i) $AB + \overline{A}\,\overline{B} + \overline{A}BC$

(ii) $A + B\left[C + D\left(B + \overline{C}\right)\right]$

(e) Construct a truth table for each of the following Boolean expressions : 2+3=5

(i) $(A + B)C$

(ii) $(AB + C)\overline{B}$

(f) What is Gray Code ? 1

2. (a) Using Boolean algebra, simplify each expression : 3+1+1+1+2+1=9

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

(ii) $BC + \overline{B}C$

(iii) $A(A+B)$

(iv) $A(\overline{A}+AB)$

(v) $(B+BC)(B+\overline{B}C)(B+D)$

(vi) $A(A+\overline{A}B)$

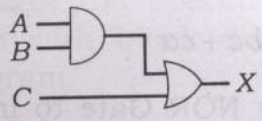
(b) Convert the following expressions to sum of product (SOP) forms : 1+2=3

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

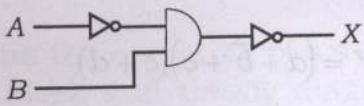
(ii) $(A+C)(AB+AC)$

(c) Write the Boolean expression for each of the logic circuits 1+1=2

(i)



(ii)



(d) Convert into canonical SOP form : 3+3=6

(i) $a'+bc$

(ii) $xy+x'z$

3. *(a)* Use Karnaugh map to simplify each expression to a minimum SOP form : 4+5+6=15

(i) $\overline{A}\,\overline{B}\,\overline{C} + A\overline{B}C + \overline{A}BC + AB\overline{C}$

(ii) $\overline{A}\,\overline{B}\,\overline{C}\,\overline{D} + \overline{A}\,\overline{B}\,\overline{C}D + ABCD + ABC\overline{D}$

(iii) $f(w,x,y,z)$
$= \sum m(0,1,2,3,4,11,13,14) + d(5,6)$

(b) Draw a 4–variable Karnaugh map and label each cell according to its binary value. 5

4. *(a)* Use only NAND Gate to implement : 3

$Y = ab + bc + ca$

(b) Use only NOR Gate to implement : 3

$Y = (a + \overline{b} + c)(c + d)$

(c) State and prove De-Morgan's theorem. 2+5=7

(d) Design a 2 to 4 Decoder. 5

(e) Write down the truth table of a X-NOR Gate. 2

5. (a) Design a 8:1 Multiplexer. 5

(b) Describe the operation of a S–R latch with circuit diagram and Function table. 6

(c) Write down the truth table of a J–K latch. 3

(d) Draw the Block diagram of a 3 bit ripple carry adder. 3

(e) Write down the truth table of a 4 to 2 encoder. 2

(f) Define Logic Gate. 1

6. (a) Design a Mod-7 Counter. 13

(b) Explain the operation of a M–S Flip Flop with block diagram and timing diagram. 7

7. (a) Explain the operation of a 4 bit register with block and timing diagram. 10

(b) Draw the block diagram of a 2 bit asynchonous counter and explain its counting operation with timing diagram. 10