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Subject :- Digital Systems

CIE – 1

1. Sol^n →

2 | 163	
2 | 81	– 1
2 | 40	– 1
2 | 20	– 0
2 | 10	– 0
2 | 5	– 0
2 | 2	– 1
1	– 0

$0.875 \times 2 = 1.750$ → 1

$0.75 \times 2 = 1.50$ → 1

$0.5 \times 2 = 1.0$ → 1

$\therefore 0.875_{10} = 0.111_2$

$\therefore 163_{10} = 10100011_2$

$\therefore \boxed{163.875_{10} = 10100011.111_2}$

2. (a) Sol^n :-

2 | 37	
2 | 18	– 1
2 | 9	– 0
2 | 4	– 1
2 | 2	– 0
1	– 0

$\therefore 37_{10} = 100101_2$

$\therefore -37_{10} = 011010$ (1s complement)

$\therefore -37_{10} = 011011$ (2s complement)

$\therefore \boxed{-37_{10} = 111111\ 011011}$ (2s complement 12-bit)

(b) Sol^n :-

2 | 173	
2 | 86	– 1
2 | 43	– 0
2 | 21	– 1
2 | 10	– 1
2 | 5	– 0
2 | 2	– 1
1	– 0

$\therefore 173_{10} = 10101101_2$

$\therefore -173_{10} = 01010010_2$ (1s form)

$\therefore \boxed{-173_{10} = 111101010011}$ (2s complement, 12 bit)

2.(c) Sol^n:

2 | 65
2 | 32 – 1
2 | 16 – 0
2 | 8 – 0
2 | 4 – 0
2 | 2 – 0
1 – 0

$0.5 \times 2 = 1.0$ (1)

$\therefore 65_{10} = 1000001_2$ $\quad$ $\therefore 0.5_{10} = 0.1_2$

$\therefore 65.5_{10} = 1000001.1_2$

↓

0111110.0 (1s complement)

↓

$\therefore -65.5_{10} = 10111110.1000$ (2s complement 12-bit)

2. (d) Sol^n:

2 | 197
2 | 98 – 1
2 | 49 – 0
2 | 24 – 1
2 | 12 – 0
2 | 6 – 0
2 | 3 – 0
1 – 1

$0.5 \times 2 = 1.0$ (1)

$\therefore 0.5_{10} = 0.1_2$

$\therefore 197_{10} = 11000101_2$

$\therefore 197.5_{10} = 11000101.1_2$

↓

00111010.0 (1s complement)

↓

$\therefore -197.5 = 100111010.100$ (2s complement 12 bit)

3) Sol'n:

2 | 47	
2 | 23 – 1	
2 | 11 – 1	
2 | 5 – 1	
2 | 2 – 1	
1 – 0	

$0.25 \times 2 = 0.5 \rightarrow 0$

$0.5 \times 2 = 1.0 \rightarrow 1$

$\therefore 0.25_{10} = 0.01_2$

$\therefore 47_{10} = 101111_2$

$\therefore 47.25_{10} = 101111.01_2$, which is in 2s complement form

And,

2 | 55	
2 | 27 – 1	
2 | 13 – 1	
2 | 6 – 1	
2 | 3 – 0	
1 – 1	

$0.75 \times 2 = 1.5 \rightarrow 1$

$0.5 \times 2 = 1.0 \rightarrow 1$

$\therefore 0.75_{10} = 0.11_2$

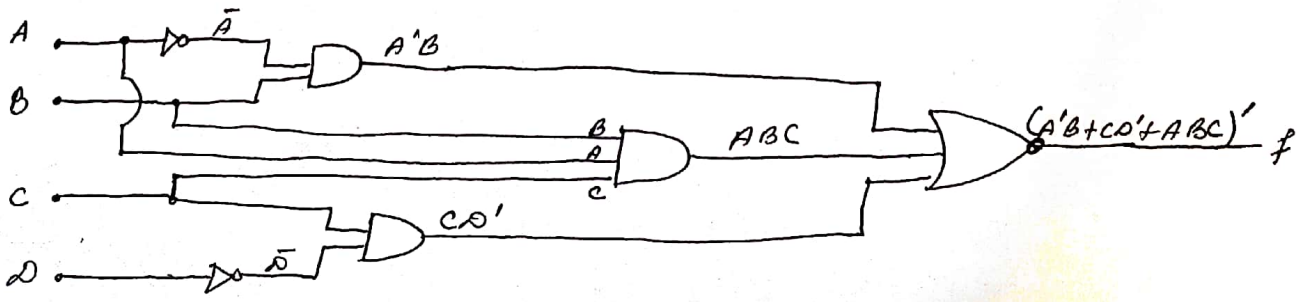
$\therefore 55_{10} = 110111$

$\therefore 55.75_{10} = 110111.11_2$, which is in 2s complement form.

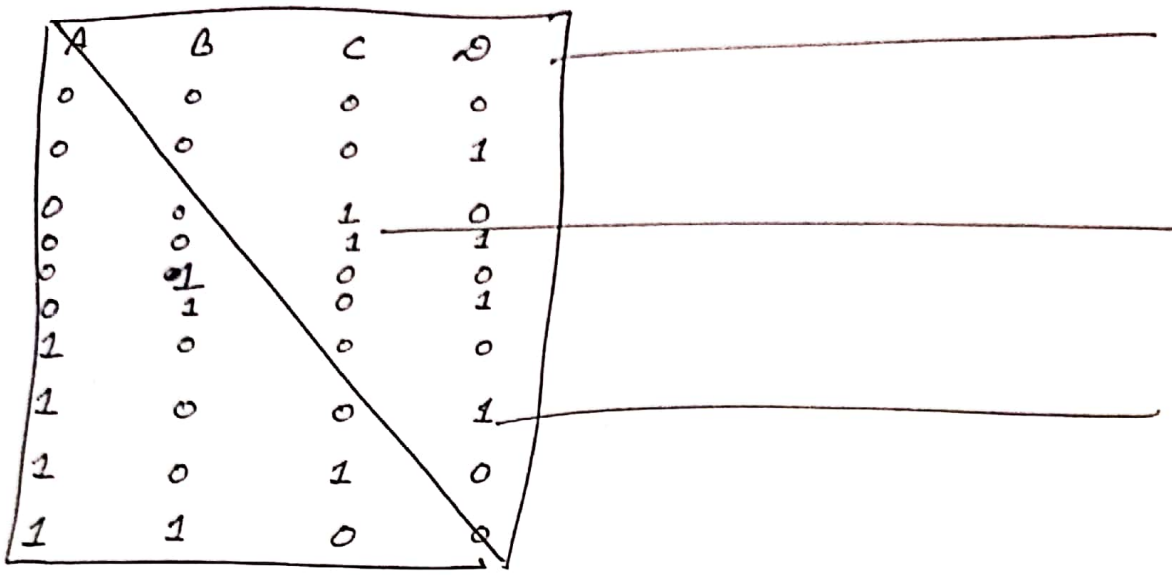
$$\begin{array}{r} 101111.01 \\ +\ 110111.11 \\ \hline 100111.00 \end{array}$$

$\therefore$ Reqd. answer : 100111.00

4) Ans: Given, $f = (A'B + CD' + ABC)'$



Truth table:



Truth Table

A	B	C	D	A'	A'B	D'	CD'	ABC	A'B+CD'+ABC	(A'B+CD'+ABC)'
0	0	0	0	1	0	1	0	0	0	1
0	0	0	1	1	0	0	0	0	0	1
0	0	1	0	1	0	1	1	0	1	0
0	0	1	1	1	0	0	0	0	0	1
0	1	0	0	1	1	1	0	0	1	0
0	1	0	1	1	1	0	0	0	1	0
0	1	1	0	1	1	1	1	0	1	0
0	1	1	1	1	1	0	0	0	1	0
1	0	0	0	0	0	1	0	0	0	1
1	0	0	1	0	0	0	0	0	0	1
1	0	1	0	0	0	1	1	0	1	0
1	0	1	1	0	0	0	0	0	0	1
1	1	0	0	0	0	1	0	0	0	1
1	1	0	1	0	0	0	0	0	0	1
1	1	1	0	0	0	1	1	1	1	0
1	1	1	1	0	0	0	0	1	1	0

5) (i) Sol":- $AB + (AC)' + AB'C(AB+C)$

$= AB + A'+C' + AB'CAB + AB'CC$ [$(AC)' = A'+C'$, De Morgan's]

$= AB + A'+C' + 0 + AB'C$ [$CC = C$, $BB' = 0$]

$= AB + A' + C' + AB'C$

$= A(B + B'C) + A'+C'$

$= A(B+C) + A'+C'$ [$\because A + A'B = A+B$]

$= AB + AC + A'+C'$

$= (A' + AB) + (C' + CA)$

$= A' + B + C' + A$ [$\because A + A'B = A + B$]

$= A + A' + B + C'$

$= 1 + B + C'$ [$\because A + A' = 1$]

$= 1$ //

5. (ii) Sol":- $A + B + A'B'C$

$= A(B+B')(C+C') + B + A'B'C$

$= (AB + AB')(C+C') + B + A'B'C$

$= ABC + ABC' + AB'C + AB'C' + B + A'B'C$

$= B + ABC + ABC' + AB'C' + B'C(A+A')$

$= B + ABC + ABC' + AB'C' + B'C$

$= B + AB(C+C') + AB'C' + B'C$

$= B + AB + AB'C' + B'C$

$= (B + AB) + B'(C + C'A)$

$= (B + AB) + B'(C + A)$ //

5. (ii) Sol^n: $(wx + wy')(x + w) + wx(x' + y')$

$= wxx + wwx + wxy' + wwy' + wxx' + wxy'$

$= \underline{wx + wx} + \underline{wxy'} + wy' + w \cdot 0 + \underline{wxy'}$ [$\because xx = x$, $ww = w$, $x\bar{x} = 0$]

$= wx + wxy' + wy'$

$= wx + wy'(1 + x)$

$= wx + wy' \cdot 1$ [$\because 1 + x = 1$]

$= wx + wy'$

$= w(x + y')$ //

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