6- Binary - Octal and Octal - Binary Conversions :-

An octal number can be converted into binary equivalent by replacing each octal digit with its three-bit binary equivalent because the ($8 = 2^3$). A binary number can be converted into an equivalent octal number by splitting the integer and fractional parts into groups of three bits, starting from binary point on both sides. The 0s can be added to complete the outside groups if needed.

Ex 15 :- Convert each of the following Octal numbers to Binary

a) $(13)_8$ (b) $(7526)_8$ (c) $(1.52)_8$

Solution:-

(a) $(13)_8 \longrightarrow (1\,011)_2$

13

001 011

(b) $(7526)_8 \longrightarrow (111\,101\,010\,110)_2$

7 5 2 6

111 101 010 110

(c) $(1.52)_8 \longrightarrow (1.101\,01)_2$

1.52

001 . 101 010

Table (1)
Octal / Binary Conversion

Octal Digit	Binary (2^2 2^1 2^0)
0	0 0 0
1	0 0 1
2	0 1 0
3	0 1 1
4	1 0 0
5	1 0 1
6	1 1 0
7	1 1 1

Ex.16:- Convert each of the following binary number to Octal

a)$(110101)_2$ b)$(1101000001000)_2$ c)$(1110100.0100111)_2$
d)$(110101.1)_2$ e) $(10101.001)_2$

Solution:— a)$(110101)_2 \longrightarrow (65)_8$

110 101
6 5

b)$(1101000001000)_2 \longrightarrow (3204)_8$

011 010 000 100
3 2 0 4

c)$(1110100.0100111)_2 \longrightarrow (164.234)_8$

001 110 100 . 010 011 100
1 6 4 2 3 4

d)$(110101.1)_2 \longrightarrow (65.1)_8$

110 101 . 100
6 5 . 1

e)$(10101.001)_2 \longrightarrow (25.1)_8$

010 101 . 001
2 5 . 1

7- Hex - Binary and Binary - Hex Conversions:-

A hexadecimal number can be converted into its binary equivalent by replacing each hex digit with its four-bit binary equivalent because the $(16 = 2^4)$. A binary number can be converted into an equivalent hexadecimal number by splitting the integr and fractional parts into groups of four bits, starting from the binary point on both sides. The 0s can be added to complete the outside groups if needed.

Ex.17:- Convert each of the following hexadecimal numbers to binary:-

a) $(10A4)_{16}$ b) $(CF8E)_{16}$ c) $(2B.A)_{16}$

Solution:-

a) $(10A4)_{16} \rightarrow (0001\ 0000\ 1010\ 0100)_2$

1 0 A 4

0001 0000 1010 0100

b) $(CF8E)_{16} \rightarrow (1100\ 1111\ 1000\ 1110)_2$

C F 8 E

1100 1111 1000 1110

Table 2: Hex/binary conv.

Hex digit	Binary Digit (8 4 2 1)
0	0 0 0 0
1	0 0 0 1
2	0 0 1 0
3	0 0 1 1
4	0 1 0 0
5	0 1 0 1
6	0 1 1 0
7	0 1 1 1
8	1 0 0 0
9	1 0 0 1
A	1 0 1 0
B	1 0 1 1
C	1 1 0 0
D	1 1 0 1
E	1 1 1 0
F	1 1 1 1

c) $(2B.A)_{16} \rightarrow (101011.101)_2$

2 B . A

0010 1011 . 1010

Ex.18:- Convert the following binary numbers to hexadecimal:-

a) $(1100\ 1010\ 0101\ 0111)_2$ b) $(1111100010110100 1)_2$

c) $(1011\ 0001\ 1010\ 1011.\ 1111\ 0010)_2$

Solution:- a) $(1100\ 1010\ 0101\ 0111)_2 \rightarrow (CA57)_{16}$

b) $(0011\ 1110\ 0010\ 1101\ 0011)_2 \rightarrow (3F169)_{16}$

c) $(0010\ 1100\ 0110\ 1011.\ 1111\ 0010)_2 \rightarrow (2C6B.F2)_{16}$

8- Hex-octal and Octal to Hex Conversions:-

For hexadecimal-octal conversion, the given hex number is firstly converted into its binary equivalent which is further converted into its octal equivalent.

Hex number → Binary number → octal number

For octal-hexadecimal conversion, the octal number may first be converted into equivalent binary number and then the binary number transformed into its hex equivalent.

octal number → Binary number → Hex number

Ex.19:- Find the octal equivalent of $(2F.C4)_{16}$ and the hex equivalent of $(762.013)_8$.

Solution:- $(2F.C4)_{16} \rightarrow (0010\ 1111.1100\ 0100)_2 \rightarrow (57.61)_8$

$(762.013)_8 \rightarrow (111\ 110\ 010.000\ 001\ 011) \rightarrow (1F2.058)_{16}$

(H.W)(1):- Convert the following binary numbers to octal, hexadecimal and decimal numbers:-

a) $(1101)_2$ b) $(0.101)_2$ c) $(0.01101)_2$ d) $(10101.11)_2$

(H.W)(2):- Convert the following octal numbers to binary, hexadecimal and decimal numbers:-

a) $(65)_8$ b) $(240.51)_8$ c) $(2000)_8$ d) $(177777)_8$

(H.W)(3):- Convert each of the following hexadecimal numbers to binary, octal and decimal numbers:-

a) $(4F)_{16}$ b) $(F8.A7)_{16}$ c) $(2000)_{16}$ d) $(20b4)_{16}$.