c) $(31.6)_8 \rightarrow$

8^1	8^0	.	8^{-1}
8	1	.	0.125
3	1	.	6

$= (3 \times 8) + (1 \times 1) + (6 \times 0.125)$

$= (25.75)_{10}$

$\therefore (31.6)_8 \rightarrow (25.75)_{10}$

(b) H.W

5- Hexadecimal to decimal conversion:-

ex) Convert the following hexadecimal numbers to decimal.

a) $(1C)_{16}$ b) $(A85)_{16}$ c) $(F5.AB.85)_{16}$

Sol.)

a) $(1C)_{16} \rightarrow$

16^1	16^0
16	1
1	C (12)

$= (1 \times 16) + (C \times 1) = (28)_{10}$

$\therefore (1C)_{16} \rightarrow (28)_{10}$

b) $(A85)_{16} \rightarrow$

16^2	16^1	16^0
256	16	1
A (10)	8	5

$= (A \times 256) + (8 \times 16) + (5 \times 1)$

$= 2560 + 128 + 5$

$= (2693)_{10}$

$\therefore (A85)_{16} \rightarrow (2693)_{10}$

(c) H.W

6-Binary to octal conversion:-

The base for octal numbers is 8 and the base for binary numbers is 2. The base for octal number is the third power of the base for binary numbers.

digits of octal	binary with 3-bits (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] Convert the following binary numbers to octal:-

a) $(110101)_2$ b) $(101111001)_2$ c) $(110011001010)_2$

Sol.)

a) 1 1 0 1 0 1

6 5

$\therefore (110101)_2 \rightarrow (65)_8$

b) 1 0 1 1 1 1 0 0 1

5 7 1

$\therefore (101111001)_2 \rightarrow (571)_8$

c) 0 0 1 1 0 0 1 1 0 0 1 1 0 1 0

1 4 6 3 2

$\therefore (110011001010)_2 \rightarrow (14632)_8$

7- Octal to binary conversion:-

Conversion from octal to binary is a reversal of the previous process.

ex] Convert the following octal numbers to binary?

a) $(13)_8$ b) $(25)_8$ c) $(7526)_8$ d) $(1.52)_8$

Sol.) a)

1 3
↓ ↓
001 011

$\therefore (13)_8 \rightarrow (001011)_2$

b) H.w

c)

7 5 2 6
↓ ↓ ↓ ↓
111 101 010 110

$\therefore (7526)_8 \rightarrow (111101010110)_2$

d)

1 . 5 2
↓ ↓ ↓
001 101 010

$\therefore (1.52)_8 = (001.101010)_2$

8- Binary to hexadecimal conversion:-

The base of hexadecimal numbers is 16 and the base of binary numbers is 2. The base for hexadecimal number is the fourth power of the base for binary numbers. Therefore, by grouping 4 digits of binary numbers and then converting each group digit to its hexadecimal equivalent we can convert binary number to its hexadecimal equivalent.

digits of hexadecimal	binary with 4-bits (2^3 2^2 2^1 2^0 = 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

ex) Convert the following binary numbers to hexadecimal.

a) $(1101100010011011)_2$ b) $(1011000110101111.11110010)_2$

sol.)

a) 1101 1000 1001 1011

D 8 9 B

$\therefore (1101100010011011)_2 \rightarrow (D89B)_{16}$

b) 0010 1100 0110 1011 . 1111 0010

2 C 6 B . F 2

$\therefore (1011000110101111.11110010)_2 \rightarrow (2C6B.F2)_{16}$

H.W Repeat the previous example with $(1111110001011010011)_2$.

9- Hexadecimal to binary Convertion:-

Conversion from hexadecimal to binary is a reversal of the previous process, where each digit of the hexadecimal number is converted to its binary equivalent to get hexadecimal to binary conversion of the number.

ex) Convert the following hexadecimal numbers to binary.

a) $(3FD)_{16}$ b) $(5A9.B4)_{16}$ c) $(1C)_{16}$

Sol.)

a)

3	F	D
↓	↓	↓
0011	1111	1101

$\therefore (3FD)_{16} \rightarrow (001111111101)_2$

b)

5	A	9	.	B	4
↓	↓	↓		↓	↓
0101	1010	1001	.	1011	0100

$\therefore (5A9.B4)_{16} \rightarrow (010110101001.10110100)_2$

c) H.w

10- Octal to hexadecimal conversion:-

To convert octal number to hexadecimal number:-

1- Convert octal number to its binary equivalent.
2- Convert binary number to its hexadecimal equivalent.

ex) Convert $(615)_8$ to its hexadecimal equivalent.

Sol.)

1- Convert octal to binary.

6	1	5
110	001	101

$(615)_8 \rightarrow (110001101)_2$

2- Convert binary to hexadecimal.

0001	1000	1101
1	8	D

$\therefore$ hexadecimal number $= (18D)_{16}$

II) Hexadecimal to octal convertions:-

To convert hexadecimal number to octal number:-

1- Convert hexadecimal number to its binary equivalent.

2- Convert binary number to its octal equivalent.

ex) Convert $(25B)_{16}$ to its octal equivalent.

Sol.)

1- Convert hexadecimal to binary -

2 5 B

0010 0101 1011

$(25B)_{16} \rightarrow (001001011011)_2$

2- Convert binary to octal.

001 001 011 011

1 1 3 3

$\therefore$ Octal number = $(1133)_8$

H.W

1- Convert the following decimal numbers to: a) octal b) hexadecimal: 1) $(98)_{10}$ 2) $(163.25)_{10}$ 3) $(723)_{10}$

2- Convert the following octal numbers to: a) binary b) decimal: 1) $(125)_8$ 2) $(173.45)_8$ 3) $(2220)_8$

3- Convert the following hexadecimal numbers to: a) binary b) decimal: 1) $(CC2B)_{16}$ 2) $(4AFC.B3)_{16}$