* Analog ⇒ Continous signal

* Digital ⇒ Discontinouse signal

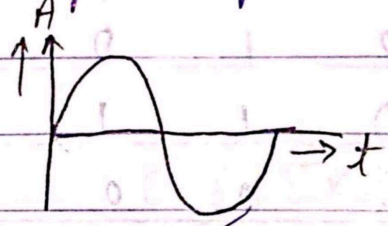
1. Binary number system
Base or Radix = (2), 0, 1

2. Octal number system
Base or Radix = (8), 0, 1, 2, 3, 4, 5, 6, 7

3. Decimal number system
Base = (10), 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

4. Hexadecimal number system
Base = (16), 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10(A), 11(B), 12(C), 13(D), 14(E), 15(F)

* Analog ⇒ Analog signal is continuous signal analog device are diode transistors op-amp. timers etc.



* Digital ⇒ Digital signal is used discontinous signal or discrete signals. Digital signal are in the form in pulse.

★ Number system

$2^{-1} = 1/2 = 0.5$

$2^{-2} = 1/4 = 0.25$

$2^{-3} = 1/8 = 0.125$

$2^{-4} = 1/16 = 0.0625$

(a) Binary to decimal conversion

$(1011)_2 = (\quad)_{10}$

$2^3 \times 1 + 2^2 \times 0 + 2^1 \times 1 + 2^0 \times 1$

$8 + 2 + 1 = 11$

Code 8421 use this to calculate all type number system

Binary to decimal conversion

Binary				Decimal
B_3	B_2	B_1	B_0	
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10

3. Decimal to binary ⇒

$(54.6)_{10} = (110110.1001)_2$

2 | 54	
2 | 27 – 0	$0.6 \times 2 = 1.2 \Rightarrow 1$
2 | 13 – 1	$0.2 \times 2 = 0.4 \Rightarrow 0$
2 | 6 – 1	$0.4 \times 2 = 0.8 \Rightarrow 0$
2 | 3 – 0	$0.8 \times 2 = 1.6 \Rightarrow 1$
1 – 1	

For example ⇒

(1) $(1\,0\,1\,1\,1.\,1011)_2 = (\quad)_{10}$ (powers: $2^4\ 2^3\ 2^2\ 2^1\ 2^0$. $2^{-1}\ 2^{-2}\ 2^{-3}\ 2^{-4}$)

$2^4 \times 1 + 2^3 \times 0 + 2^2 \times 1 + 2^1 \times 1 + 2^0 \times 1 + 2^{-1} \times 1 + 2^{-2} \times 0 + 2^{-3} \times 1 + 2^{-4} \times 1$

$16 + 0 + 4 + 2 + 1 + 0.5 + 0 + 0.125 + 0.0625$

$\Rightarrow 23.6875$

(2) $(43.625)_{10} = (\quad)_2$

2 | 43	
2 | 21 – 1	$0.625 \times 2 = 1.25 \Rightarrow 1$
2 | 10 – 1	$0.25 \times 2 = 0.5 \Rightarrow 0$
2 | 5 – 0	$0.5 \times 2 = 1.01 \Rightarrow 1$
2 | 2 – 1	
1 – 0	

$\Rightarrow (101011.101)$

Octal to decimal

$(205)_8 = (\quad)_{10}$

$8^2 \times 2 + 8^1 \times 0 + 8^0 \times 5$

$128 + 0 + 5 \Rightarrow 133$

Decimal to octal

$(133)_{10} = (205)_8$

8	133
8	16 - 5
	2 - 0

$\Rightarrow 205$

$(122.225)_{10} = (\quad)_8$

8	122
8	15 - 2
	1 - 7

$0.225 \times 8 = 1.8 \Rightarrow 1$

$0.8 \times 8 = 6.4 \Rightarrow 6$

$0.4 \times 8 = 3.2 \Rightarrow 3$

$0.2 \times 8 = 1.6 \Rightarrow 1$

$0.6 \times 8 = 4.8 \Rightarrow 4$

$\Rightarrow (172.16314)_8$

Decimal to hexadecimal

$(424)_{10} = (\quad)_{16}$

16	424
16	26 - 8
	1 - 10 (A)

$\Rightarrow (1\ A\ 8)_{16}$

Hexadecimal to decimal

(1) $(1A8)_{16} = (424)_{10}$

$16^2 \times 1 + 16^1 \times 10 + 16^0 \times 8$

$256 + 160 + 8$

$\Rightarrow 424$

(2) $(2FA)_{16} = (762)_{10}$

$16^2 \times 2 + 16^1 \times 15 + 16^0 \times 10$

$512 + 240 + 10$

$\Rightarrow 762$

For example:

$(89.5)_{10} = (1011001.1)_2 = (131.4)_8 = (59.8)_{16}$

2	89
2	44 - 1
2	22 - 0
2	11 - 0
2	5 - 1
2	2 - 1
	1 - 0

$0.5 \times 2 = 1$

2	89
2	11 - 1
	1 - 3

$0.5 \times 8 = 4.0 \Rightarrow 4$

16	89
	5 - 9

$0.5 \times 16 = 8.0 \Rightarrow 8$

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