Dr. Shiva Kant Mishra
Deptt. of Physics
H. D. Jain College, Ara

M. Sc. Sem II
Paper - MPHY CC-7
Electronics I

Digital Electronics

Number System

As the term digital implies a system of coupling using discrete units, there are four systems of arithmetic:

1.) The Decimal Number System:

This is frequently used Number system in our daily life. It contains 10 unique symbols: 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. Because it has symbols its base used is to be 10. To indicate digits greater than 9 the digits are arranged by columns on the left of decimal point each column having a different weight or multiplying factor, e.g. they are named as hundreds, tens and units. Similarly, to represent digits less than 1, the position to the right of the decimal point are named as tenths, hundredths, thousandths etc.

For example, Number:

$432.45_{10} = 4\times10^2 + 3\times10^1 + 2\times10^0 + 4\times10^{-1} \times 5\times10^{-2}$.

2.) The Binary Number System:

The Binary Number system uses only two digits 0 and 1, as contrasted to the ten digits of the decimal system. The base for this system is 2 and the positions to the left or right of the binary point carry weights increasing or decreasing in powers of 2. For example, Number:

$101011_2 = 1\times2^5 + 0\times2^4 + 1\times2^3 + 0\times2^2 + 1\times2^1 + 1\times2^0$

$= 32 + 0 + 8 + 0 + 2 + 1 = 43_{10}$ in Decimal

$0.1101 = 1\times2^{-1} + 1\times2^{-2} + 0\times2^{-3} + 1\times2^{-4}$

$= 1/2 + 1/4 + 0 + 1/16 = 0.500 + 0.250 + 0.062$ Decimal

$= 0.812_{10}$.

So That $101011.1101_2 = 43.812_{10}$.

Note That in a binary operation only two states are possible. For example, in logic, a statement in characterized as true or false. A switch may be open or closed. Its equivalent in electronics is a transistor operating at cutoff or at saturation but not in its active region. However, binary arithmetic and mathematical manipulation of switching or logic function are best carried out which involves two symbols, 0 and 1, as explained above.

Converting binary to Decimal :

This Process is easy and has been illustrated above. The Column Weights for each 1 appearing in The number are noted and are added to all other Column weights Containing a 1. For example to convert 10111_2 to decimal, we write

$$10111_2 = 1\times2^4 + 0\times2^3 + 1\times2^2 + 1\times2^1 + 1\times2^0$$
$$= 16 + 0 + 4 + 2 + 1 = 23_{10}.$$

Converting decimal to binary :

For This, Number is successively divided by 2 and its remainder recorded. The final binary result is obtained by assuming all The remainders, with the last remainder being The most significant bit (MSB). For example, to convert 43_{10} to binary, we Proceed as follows.

2	43 - R
2	21 - 1
2	10 - 1
2	5 - 0
2	2 - 1
2	1 - 0
	0 - 1

Reading the remainders from bottom to top,

$43_{10} = 101011_2$.

Example 1 Convert 200_{10} into binary

2	200 - R
2	100 - 0
2	50 - 0
2	25 - 0
2	12 - 1
2	6 - 0
2	3 - 0
2	1 - 1
	0 - 1

$200_{10} = 11001000_2$.

Ex-2 Convert $(594375)_{10}$ into binary.

Integer Part $(55)_{10} = (111011)_2$ find as ex-1

Fractional Part

$0.4375 = 0.4375 \times 2 = 0.8750 \rightarrow 0$

$0.8750 \times 2 = 1.7500 \rightarrow 1$

$0.7500 \times 2 = 1.5000 \rightarrow 1$

$0.5000 \times 2 = 1.0000 \rightarrow 1$

So That $(0.4375)_{10} = (0.0111)_2$.

Therefore, we write:

$(59.4375)_{10} = 111011.0111_2$