



## SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

### **An Autonomous Institution**

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE NAME : 19EC306 – Digital Circuits

## II YEAR / III SEMESTER

## Unit I- MINIMIZATION TECHNIQUES AND LOGIC GATES Topic : Introduction to Digital circuits and Number systems



Introduction to Digital circuits and Number systems / 19EC306/ Digital circuits/Mr.S.HARIBABU/ECE/SNSCE





#### Number system



If base or radix of a number system is 'r', then the numbers present in that number system are ranging from zero to r-1. The total numbers present in that number system is 'r'. The following number systems are the most commonly used. •Decimal Number system

- •Binary Number system •Octal Number system
- •Hexadecimal Number system

#### Example

05-10-2023

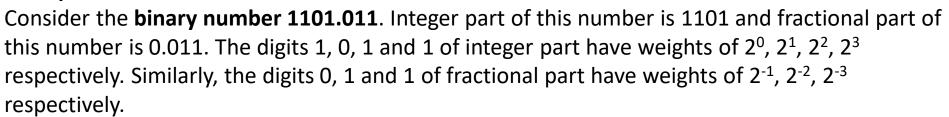
Consider the **decimal number 1358.246**. Integer part of this number is 1358 and fractional part of this number is 0.246. The digits 8, 5, 3 and 1 have weights of 100, 101,  $10^2$  and  $10^3$  respectively. Similarly, the digits 2, 4 and 6 have weights of  $10^{-1}$ ,  $10^{-2}$  and  $10^{-3}$  respectively. **Mathematically**, we can write it as

 $1358.246 = (1 \times 10^3) + (3 \times 10^2) + (5 \times 10^1) + (8 \times 10^0) + (2 \times 10^{-1}) + (4 \times 10^{-2}) + (6 \times 10^{-3})$ 





#### Example



Mathematically, we can write it as

 $1101.011 = (1 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0) + (0 \times 2^{-1}) + (1 \times 2^{-2}) + (1 \times 2^{-3})$ 

#### Example

Consider the **octal number 1457.236**. Integer part of this number is 1457 and fractional part of this number is 0.236. The digits 7, 5, 4 and 1 have weights of 8<sup>0</sup>, 8<sup>1</sup>, 8<sup>2</sup> and 8<sup>3</sup> respectively. Similarly, the digits 2, 3 and 6 have weights of 8<sup>-1</sup>, 8<sup>-2</sup>, 8<sup>-3</sup> respectively. **Mathematically**, we can write it as  $1457.236 = (1 \times 8^3) + (4 \times 8^2) + (5 \times 8^1) + (7 \times 8^0) + (2 \times 8^{-1}) + (3 \times 8^{-2}) + (6 \times 8^{-3})$ 

**Mathematically**, we can write it as for hexadecimal 1A05.2C4 =  $(1 \times 16^3) + (10 \times 16^2) + (0 \times 16^1) + (5 \times 16^0) + (2 \times 16^{-1}) + (12 \times 16^{-2}) + (4 \times 16^{-3})$ 





#### **Decimal to Binary Conversion**

#### Example

Consider the **decimal number 58.25**. Here, the integer part is 58 and fractional part is 0.25. **Step 1** – Division of 58 and successive quotients with base 2.

Operation	Quotient	Remainder
58/2	29	0 LSB
29/2	14	1
14/2	7	0
7/2	3	1
3/2	1	1
1/2	0	1 MSB



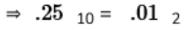
 $\Rightarrow$  58 <sub>10</sub> = 111010 <sub>2</sub>





**Step 2** – Multiplication of 0.25 and successive fractions with base 2.

Operation	Result	Carry
0.25 x 2	0.5	0
0.5 x 2	1.0	1
-	0.0	-



Therefore, the **binary equivalent** of decimal number 58.25 is 111010.01.



#### **Decimal to Octal Conversion**

#### Example

Consider the **decimal number 58.25**. Here, the integer part is 58 and fractional part is 0.25.

**Step 1** – Division of 58 and successive quotients with base 8.

Operation	Quotient	Remainder
58/8	7	2
7/8	0	7

 $\Rightarrow$  58 <sub>10</sub> = 72 <sub>8</sub>

## **Step 2** – Multiplication of 0.25 and successive fractions with base 8.

Operation	Result	Carry
0.25 x 8	2.00	2
-	0.00	-

 $\Rightarrow$  .25 <sub>10</sub> = .2 <sub>8</sub>

Therefore, the **octal equivalent** of decimal number 58.25 is 72.2.







#### **Decimal to Hexa-Decimal Conversion**

#### Example

Consider the **decimal number 58.25**. Here, the integer part is 58 and decimal part is 0.25. **Step 1** – Division of 58 and successive quotients with base 16.

Operation	Quotient	Remainder
58/16	3	10=A
3/16	0	3

$$\Rightarrow$$
 58 <sub>10</sub> = 3A <sub>16</sub>

**Step 2** – Multiplication of 0.25 and successive fractions with base 16.

Operation	Result	Carry
0.25 x 16	4.00	4
-	0.00	-

 $\Rightarrow$  .25  $_{\rm 10}$  = .4  $_{\rm 16}$ 

Therefore, the Hexa-decimal equivalent of decimal number 58.25 is 3A.4.







#### **Binary Number to other Bases Conversion**

**Binary to Decimal Conversion** 

## Example

Consider the **binary number 1101.11**.

**Mathematically**, we can write it as  $1101.11_2 = (1 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0) + (1 \times 2^{-1}) + (1 \times 2^{-2})$  $\Rightarrow 1101.11_2 = 8 + 4 + 0 + 1 + 0.5 + 0.25 = 13.75$ 

 $\Rightarrow 1101.11_{2}^{2} = 13.75_{10}$ 

## **Binary to Octal Conversion**

## Example

Consider the **binary number 101110.01101**.

**Step 1** – Make the groups of 3 bits on both sides of binary point. 101 110.011 01 Here, on right side of binary point, the last group is having only 2 bits. So, include one zero on extreme side in order to make it as group of 3 bits.  $\Rightarrow$  101 110.011 010 **Step 2** – Write the octal digits corresponding to each group of 3 bits.  $\Rightarrow$  101110.011010 <sub>2</sub> = 56.32<sub>8</sub>









# Any Query????

Thank you.....



Introduction to Digital circuits and Number systems / 19EC306/ Digital circuits/Mr.S.HARIBABU/ECE/SNSCE