Fundamentals of Computers

1. What is Computer ?

⇒ A device is called a Computer if it an electronic, programmable, general-purpose machine that takes input, process it according to stored instructions, and produces output.

2. what is an Electronic Device ?

⇒ An electronic device is a device that uses electricity to Control, process, or manipulate data or signals using electronic Components.

• It works with information, not just power.
Examples :— Computer, Laptop, Smartphone, ATM, TV etc.

3. what is an Electrical Device ?

⇒ An electrical device is an device that uses electricity mainly to produce power, heat, light or motion.

• It does not process information or data.
Examples :— Electric Fan, Bulb, Heater, Electric Iron etc.

4. what is Number System ?

⇒ A number system is a way of representing numbers using specific set of symbols (digits) and rules. In Computer Science and mathematics, number systems define how numbers are stored, processed, and understood.

5. Type of Number System ?

⇒ Four types of number system :-

i) Decimal Number System.

⇒ The Decimal number system is a base-10 number system that uses ten digits (0 to 9) to represent numbers. The value of a number depends on both the digits, and their positions. used

- Usage : used in daily life by humans.

Example :- $(245)_{10}$

NOTE :- "Is a base-10 number system" means

- Base (or radix) means the total numbers of symbols used.
- Base - 10 means :
  - There are 10 unique digits.
  - Each position represents a power of 10.

Power of 10 : $10^0, 10^1, 10^2, 10^3, - - - -$

NOTE :- "The value of a number depends on both the digits used and their positions" means

Example :-

- what is the value of number 576.

$$576 = (5 \times 10^2) + (7 \times 10^1) + (6 \times 10^0)$$
$$= 500 + 70 + 6$$
$$= 576$$

- 6 is unit place, so it's position is 10^0.
- 7 is ten place, so it's position is 10^1.
- 5 is hundred place, so it's position is 10^2.
- Now, value of number 576 is Five Hundred Seventy-Six in decimal Number System.

ii) Binary Number System.

$\Rightarrow$ The Binary number system is a base-2 number system that uses two digits (0 and 1) to represent numbers. The value of a number depends on both the digits used and their positions.

- Usage : Used by computers and digital systems.
  Example :— $(1011)_2$

NoTE :— " Is a base-2 number system" means

- Base (or radix) means the total number of symbols used.
- Base-2 means :
  - There are 2 unique digits.
  - Each position represents a power of 2.

Power of 2 : $2^0, 2^1, 2^2, 2^3, ----$

NOTE:— "The value of a number depends on both the digits used and their positions" means.

Example :—

• what is the value of number 11001.

$$11001 = (1 \times 2^4) + (1 \times 2^3) + (0 \times 2^2) + (0 \times 2^1) + (1 \times 2^0)$$
$$= 16 + 8 + 0 + 0 + 1$$
$$= 25.$$

• 1 is unit place, so it's position is 2^0.
• 0 is two place, so it's position is 2^1.
• 0 is four place, so it's position is 2^2.
• 1 is eight place, so it's position is 2^3.
• 1 is sixteen place, so it's position is 2^4.
• Now, value of number 11001 is Twenty Five in decimal Number System.

iii) Octal Number System.

⇒ The Octal number system is a base-8 number system that uses eight digits (0 to 7) to represent numbers. The value of a number depends on both the digits used and their positions.

• Usage : Used in some computer applications as a shorthand for binary.

Example :— $(345)_8$

NOTE :— " Is a base-8 number system." means

- Base (or radix) means the total number of symbols used.
- Base-8 means:
  - There are 8 unique digits.
  - Each position represents a power of 8.

Power of 8 : $8^0, 8^1, 8^2, 8^3, ----$

NOTE :— " The value of a number depends on both the digits used and their positions." means

Examples:—
  - What is the value of number 345.

$$345 = (3 \times 8^2) + (4 \times 8^1) + (5 \times 8^0)$$
$$= 192 + 32 + 5$$
$$= 229.$$

  - 5 is unit place, so it's position is 8^0.
  - 4 is eight place, so it's position is 8^1.
  - 3 is sixty-four place, so it's position is 8^2.
  - Now, value of number 345 is Two Hundred Twenty-Nine in decimal Number System.

iv) Hexadecimal Number System.

⇒ The Hexadecimal number system is base-16 number system that uses sixteen symbols (0-9 and A-F) to represent numbers. The

value of a number depends on both the digits used and their positions.

- Usage: widely used in programming, memory addressing, and Color codes.

Example : (2F)₁₆

NOTE :- "Is a base-16 number system" means

- Base (or radix) means the total number of symbols used.
- Base-16 means:-
  - There are 16 unique digits.
  - Each position represents a power of 16.

Power of 16: $16^0, 16^1, 16^2, 16^3, ---$

NOTE :- "The value of a number depends on both the digits used and their positions" means

Example:-
- what is the value of number 27F.

$$27F = (2 \times 16^2) + (7 \times 16^1) + (15 \times 16^0)$$
$$= 512 + 112 + 15$$
$$= 639$$

- F is unit place, so it's position is 16^0.
- 7 is sixteen place, so it's position is 16^1.
- 2 is 256 place, so it's position is 16^2.
- Now, value of number 27F is six Hundred Thirty-Nine in decimal Number System.

6. Convert Decimal to Binary.

$$2^0 = 1 \qquad\qquad 2^5 = 32$$
$$2^1 = 2 \qquad\qquad 2^6 = 64$$
$$2^2 = 4 \qquad\qquad 2^7 = 128$$
$$2^3 = 8 \qquad\qquad 2^8 = 256$$
$$2^4 = 16 \qquad\qquad 2^9 = 512$$

Example :— " what is the binary number of 145.

$$145 = 128 + 16 + 1$$
$$145 = (1 \times 2^7) + (0 \times 2^6) + (0 \times 2^5) + (1 \times 2^4) + (0 \times 2^3) +$$
$$(0 \times 2^2) + (0 \times 2^1) + (1 \times 2^0).$$
$$= 10010001.$$

7. Concept of 0's and 1's.

1.) Inside computer there is no physical significance of 0's and 1's.

2.) They are just representation of two states in the hardware.

3.) A Computer cannot store numbers, letters, or image directly.
It can only store two states : ON and OFF.

8. What is Binary Language ?

Binary language is the basic language of Computers.
It uses only two symbols: 0 and 1 to represent all data and instructions.