UNIT 1:

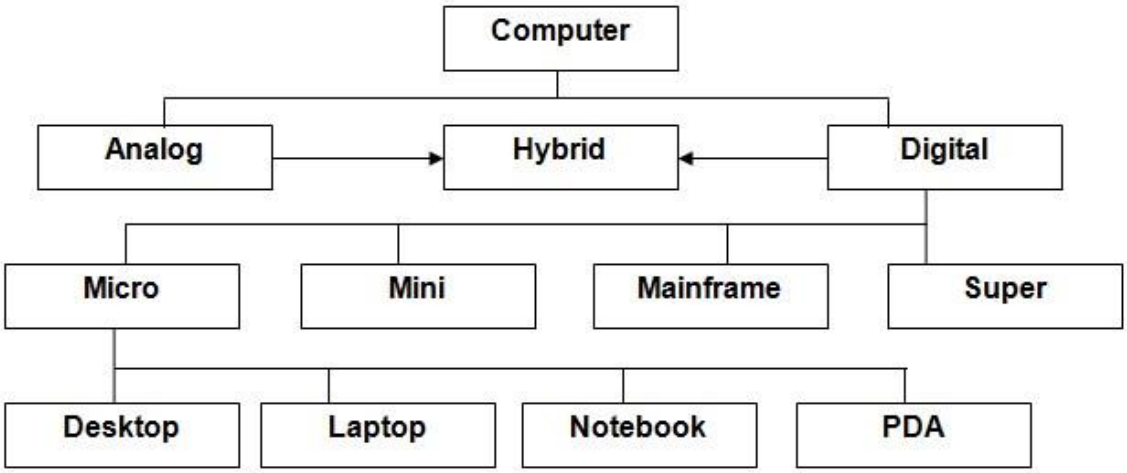
Computer Basics

Introduction to Computer –

- The term "Computer" is derived from the Latin word "Computer" which means "to compute" or "to calculate."
- Computers are machines that perform tasks or calculations according to a set of instructions or programs.
- It is an electronic device used to store data and gives the results accurately within a fraction of second.
- Computers are extensively used everywhere.
- It mainly consist of four basic unit such as,
    - Input Unit
    - Storage Unit
    - CPU
    - Output Unit

Classification of Computer

- Analog Computer
- Hybrid Computer
- Digital Computer



Characteristics of Computers –

- Computers have some important features which have made them so popular.
- A Computer can be categorized according to
  - Speed
  - Accuracy
  - Versatility
  - Reliability
  - Power of remembering
  - Diligence
  - Storage

• Speed

- Computers work at an incredible speed.
- It can carry out instructions at a very high speed.
- A powerful computer is capable of performing about 3-4 million simple instructions per second.
- It can perform arithmetic and logical operations within a fraction of second.

• Accuracy

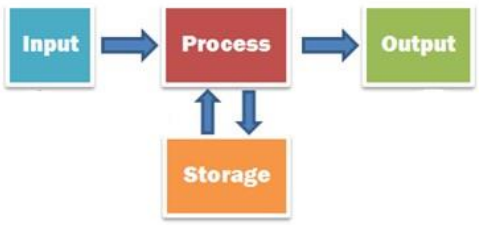
- Computer provides a high degree of accuracy.
- Computers perform all jobs with 100% accuracy.
- The degree of accuracy of a computer depends on the instruction and processor type.

- **Versatility**
    - Computer is versatile in nature.
    - It can perform different types of task easily.
    - At one moment user can use the computer to prepare a letter document and in the next moment they may play music or print a document.
- **Power of remembering**
    - A computer can store and recall any information because it has secondary storage.
    - All information can be retained as long as desired by the user and that can be recalled almost simultaneously and accurately even after several years.
- **Diligence**
    - Computers can perform long and complex calculations with the same speed and accuracy from the start till the end.
    - Being a machine, a computer does not suffer from the human traits of tiredness and lack of concentration.
- **Storage**
    - Large volume of data and information can be stored in the computer and also retrieved whenever required.
    - Computer has two types of storage. They are Primary storage and Secondary storage.
    - In Primary Storage, a limited amount of data can be stored temporarily like RAM, ROM.
    - Secondary storage can store a large amount of data permanently like floppy and compact disk.

Components of Computer System

• The computer is an electronic device that accepts (reads) data from the user and processes the data by performing calculations and operations on it, and generates (writes) the desired output.

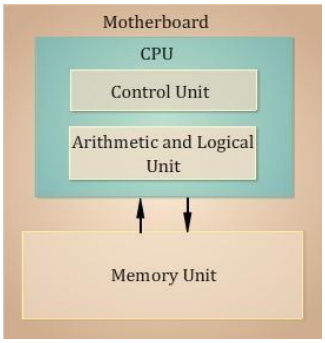
- A computer consists of four major components such as
    - Input Devices (Input Unit)
    - CPU (Processing Unit)
    - Memory (Storage Unit)
    - Output Devices (Output Unit)



Input Unit

- An input device is a hardware or peripheral device used to send data to a computer.
- An input device allows users to communicate and feed instructions and data to computers for processing, display, storage and/or transmission.
- The important and most commonly used input devices are
  - Keyboard
  - Mouse
- Other input devices are
  - Joystick
  - Scanner
  - Barcode Reader

CPU (Processing Unit)



- The CPU is the heart of the computer, it is the part of a computer which interprets and executes instruction.

Functional block of CPU

- The two components in CPU are
  - Arithmetic and logic unit (ALU)
  - Control Unit (CU)

- **Arithmetic and logic unit (ALU)**

- The ALU performs arithmetic and logical operations.
- Arithmetic operations include addition, subtraction, multiplication and division.
- Logical operations include comparing numbers, letters and special characters.
- The ALU is a fundamental building block of the Central Processing Unit of a computer.

- **Control Unit (CU)**

  - A Control Unit (CU) handles all processor control signals.
  - It directs all input and output flow, fetches code for instructions from microprograms and directs other units and models by providing control and timing signals.

Memory Unit

- Computer memory is a device that stores computer's data and programs.

FIG : Computer Memory (RAM)

- It stores program, data results or any kind of information.

- Memory stores binary information, i.e. 0's and 1's in internal storage areas in the computer.

- Moreover, the term memory is usually used as shorthand for physical memory, which refers to the actual chips capable of holding data.

- Some computers also use virtual memory, which expands physical memory onto a hard disk.

Unit	Abbreviation	Approximate Value (Bytes)	Actual Value (Bytes)
Kilobyte	KB	1,000	1,024
Megabyte	MB	1,000,000 (1 million)	1,048,576
Gigabyte	GB	1,000,000,000 (1 billion)	1,.073,741,824
Terabyte	TB	1,000,000,000,000 (1 trillion)	1,099,511,627,776

Output Unit

- Output devices are peripheral equipment that converts a computer's output to a form that can be seen, heard or used as an input for another device, process or system.
- The important output devices, which are used in computer systems are
  - Monitors
  - Printer
  - Graphic Plotter

Computer - Number System

- A computer can understand positional number system where they are only in the form of digits, alphabet, symbols, video, audio, etc.,
- But the computer can understand only 0s and 1s, so it converts all data into 0s and 1s.
- A value of each digit in a number can be determined using
  - The digit
  - The position of the digit in the number
  - The base of the number system (where base is defined as the total number of digits available in the number system).
- Number system used in the computer is classified into
  - Binary number system
  - Decimal number system
  - Octal number system
  - Hexadecimal number system

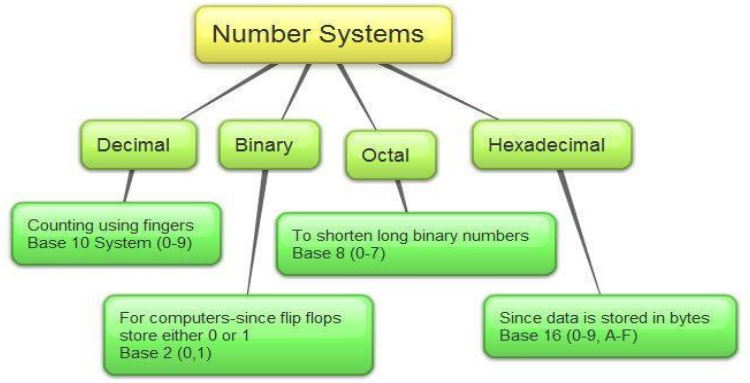


FIG: Classification of Number System

Binary number system

 The binary number system is a numbering system that represents numeric values using two unique digits (0 and 1).

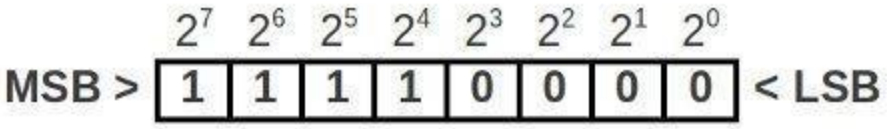
Binary	Decimal
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	10
1011	11
1100	12
1101	13
1110	14
1111	15

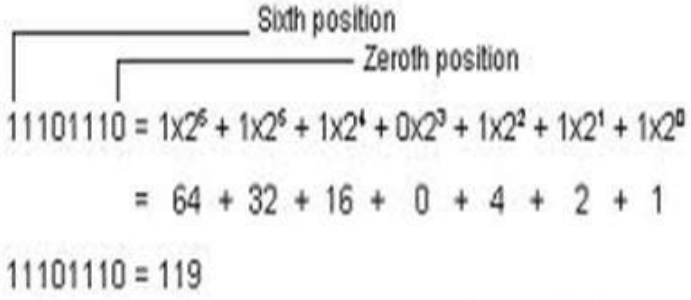
FIG : Binary and Decimal Numbers

- Each position in a binary number represents a 0 power of the base (2), that is, 2^0.
- The last position in a binary number represents x power of the base (2), that is, 2^x where x It is also called as base (2) number system.
- represents the last position 1. For e.g. $1101.101_{(2)}$

FIG : Digits Representation of Binary Number

 The leftmost bit is called Most Significant Bit (**MSB**) and the rightmost bit is called Least Significant Bit (**LSB**).





Decimal Number System

- The number system that we use in our day-to-day life is the decimal number system.
- The decimal number system has a base 10 as it uses 10 digits from 0 to 9.
- In decimal number system, to the left of the decimal point represent units, tens, hundreds, thousands and so on.
- Each position represents a specific power of the base (10).

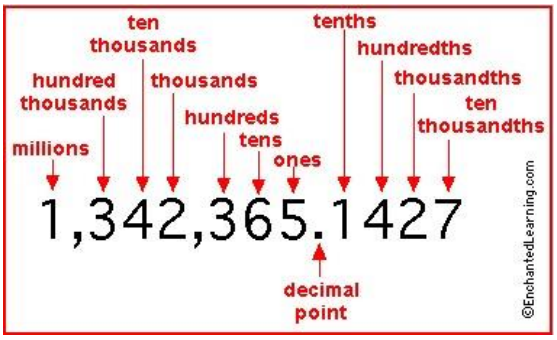


FIG : Representation of Place Values

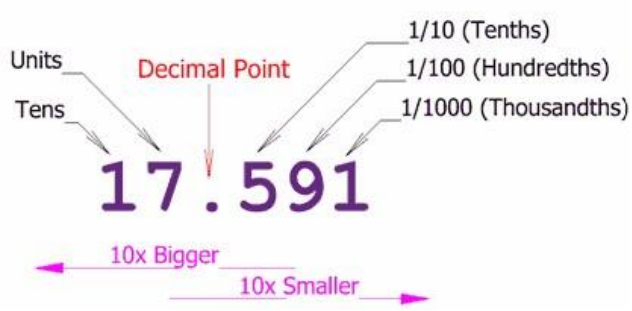
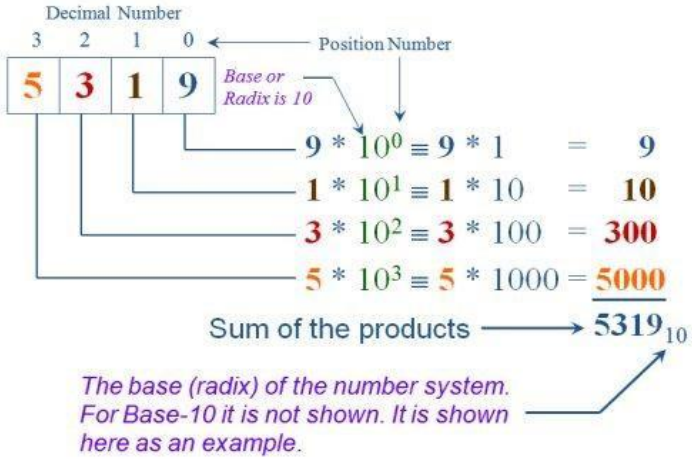


FIG : Digits Representation of Decimal Number

Example

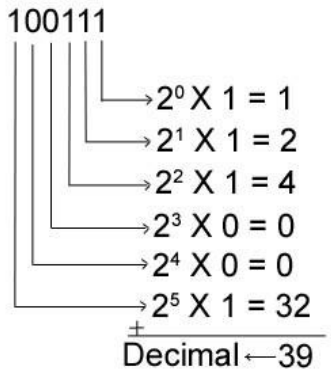


- The above example shows that, decimal number **$5319_{(10)}$**, weight of each digit is power of 10.
- Each digit has position number is from right(0) to left(3).That is first digit on right is zero, the second digit on the right is 1 and so on up to 3.

Binary to Decimal Conversion

- Multiply each bit by 2^n, where n is "weight" of bit.
- The weight is position of the bit, which starts from 0 on right, then 1 and goes on.
- Add the result. **Example**

The decimal equivalent of $100111_{(2)}$ is $39_{10)}$

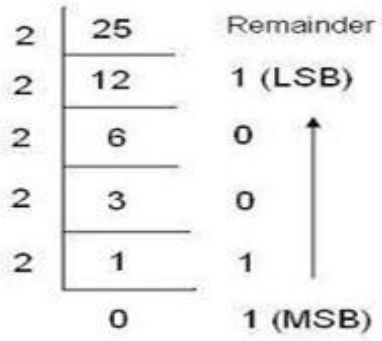


Decimal to Binary Conversions

- The easiest way to convert decimal to its binary equivalent is to use division algorithm.
- Divide by two, keep track of remainder at each step.
- Put remainder bit as 0, if that number gets divided by two.
- Put remainder bit as 1, if that number is not divided by two.

Example

The Binary equivalent of $25_{(10)}$ is $11001_{(2)}$



BCD or Binary Coded Decimal

Binary Coded Decimal, or **BCD**, is another process for converting decimal numbers into their binary equivalents.

- It is a form of binary encoding where each digit in a decimal number is represented in the form of bits.
- This encoding can be done in either 4-bit or 8-bit (usually 4-bit is preferred).
- It is a fast and efficient system that converts the decimal numbers into binary numbers as compared to the existing binary system.
- These are generally used in digital displays where is the manipulation of data is quite a task.
- Thus BCD plays an important role here because the manipulation is done treating each digit as a separate single sub-circuit.

The BCD equivalent of a decimal number is written by replacing each decimal digit in the integer and fractional parts with its four bit binary equivalent.the BCD code is more precisely known as 8421 BCD code , with 8,4,2 and 1 representing the weights of different bits in the four-bit groups, Starting from MSB and proceeding towards LSB. This feature makes it a weighted code , which means that each bit in the four bit group representing a given decimal digit has an assigned weight.
Many decimal values, have an infinite place-value representation in binary but have a finite place-value in binary-coded decimal. For example, 0.2 in binary is .001100… and in BCD is 0.0010. It avoids fractional errors and is also used in huge financial calculations.

Consider the following truth table and focus on how are these represented.

Truth Table for Binary Coded Decimal

DECIMAL NUMBER	BCD
0	0000
1	0001
2	0010
3	0011
4	0100

DECIMAL NUMBER	BCD
5	0101
6	0110
7	0111
8	1000
9	1001

In the **BCD numbering system**, the given decimal number is segregated into chunks of four bits for each decimal digit within the number. Each decimal digit is converted into its direct binary form (usually represented in 4-bits).

Introduction to ASCII Code

- **ASCII** stands for "**American Standard Code for Information Interchange**".
- ASCII character encoding provides a standard way to represent characters using numeric codes.
- These include upper and lower-case alphabetic characters, numbers, and punctuation symbols.
- ASCII was actually designed for use with teletypes and so the descriptions are somewhat obscure.
- ASCII codes are broadly classified into three groups
  - Non printable ASCII codes
  - Printable ASCII codes
  - Extended ASCII codes
- Non printable ASCII codes
  - 33 non printable special characters. The first 32 characters (decimal value from 0 to 31) which represent letters, digits, punctuation marks and a few miscellaneous symbols.

NON PRINTABLE CHARACTERS					
DEC	HEX	CHARACTER (CODE)	DEC	HEX	CHARACTER (CODE)
0	0	NULL	16	10	DATA LINK ESCAPE (DLE)
1	1	START OF HEADING (SOH)	17	11	DEVICE CONTROL 1 (DC1)
2	2	START OF TEXT (STX)	18	12	DEVICE CONTROL 2 (DC2)
3	3	END OF TEXT (ETX)	19	13	DEVICE CONTROL 3 (DC3)
4	4	END OF TRANSMISSION (EOT)	20	14	DEVICE CONTROL 4 (DC4)
5	5	END OF QUERY (ENQ)	21	15	NEGATIVE ACKNOWLEDGEMENT (NAK)
6	6	ACKNOWLEDGE (ACK)	22	16	SYNCHRONIZE (SYN)
7	7	BEEP (BEL)	23	17	END OF TRANSMISSION BLOCK (ETB)
8	8	BACKSPACE (BS)	24	18	CANCEL (CAN)
9	9	HORIZONTAL TAB (HT)	25	19	END OF MEDIUM (EM)
10	A	LINE FEED (LF)	26	1A	SUBSTITUTE (SUB)
11	B	VERTICAL TAB (VT)	27	1B	ESCAPE (ESC)
12	C	FF (FORM FEED)	28	1C	FILE SEPARATOR (FS) RIGHT ARROW
13	D	CR (CARRIAGE RETURN)	29	1D	GROUP SEPARATOR (GS) LEFT ARROW
14	E	SO (SHIFT OUT)	30	1E	RECORD SEPARATOR (RS) UP ARROW
15	F	SI (SHIFT IN)	31	1F	UNIT SEPARATOR (US) DOWN ARROW

FIG : Non-Printable ASCII characters (Codes)

 Printable ASCII codes

- 94 standard printable characters (decimal value range from 33 to 126) which represent letters, digits, punctuation marks and a few miscellaneous symbols.
- The following table originates from the older, American systems, which worked on 7-bit character tables.

PRINTABLE CHARACTERS								
DEC	HEX	CHARACTER	DEC	HEX	CHARACTER	DEC	HEX	CHARACTER
32	0x20	<SPACE>	64	0x40	@	96	0x60	`
33	0x21	!	65	0x41	A	97	0x61	a
34	0x22	"	66	0x42	B	98	0x62	b
35	0x23	#	67	0x43	C	99	0x63	c
36	0x24	$	68	0x44	D	100	0x64	d
37	0x25	%	69	0x45	E	101	0x65	e
38	0x26	&	70	0x46	F	102	0x66	f
39	0x27	'	71	0x47	G	103	0x67	g
40	0x28	(	72	0x48	H	104	0x68	h
41	0x29	)	73	0x49	I	105	0x69	i
42	0x2A	*	74	0x4A	J	106	0x6A	j
43	0x2B	+	75	0x4B	K	107	0x6B	k
44	0x2C	,	76	0x4C	L	108	0x6C	l
45	0x2D	-	77	0x4D	M	109	0x6D	m
46	0x2E	.	78	0x4E	N	110	0x6E	n
47	0x2F	/	79	0x4F	O	111	0x6F	o
48	0x30	0	80	0x50	P	112	0x70	p
49	0x31	1	81	0x51	Q	113	0x71	q
50	0x32	2	82	0x52	R	114	0x72	r
51	0x33	3	83	0x53	S	115	0x73	s
52	0x34	4	84	0x54	T	116	0x74	t
53	0x35	5	85	0x55	U	117	0x75	u
54	0x36	6	86	0x56	V	118	0x76	v
55	0x37	7	87	0x57	W	119	0x77	w
56	0x38	8	88	0x58	X	120	0x78	x
57	0x39	9	89	0x59	Y	121	0x79	y
58	0x3A	:	90	0x5A	Z	122	0x7A	z
59	0x3B	;	91	0x5B	[	123	0x7B	{
60	0x3C	<	92	0x5C	\	124	0x7C	|
61	0x3D	=	93	0x5D	]	125	0x7D	}
62	0x3E	>	94	0x5E	^	126	0x7E	~
63	0x3F	?	95	0x5F	_	127	0x7F	<DEL>

 Extended ASCII codes

- **Extended ASCII** uses eight instead of seven bits, which adds 128 additional characters.
- This gives extended ASCII the ability for extra characters, such as special symbols, foreign language letters and drawing characters.
- Some important things to note about **ASCII codes**
  - The **numeric digits**, 0-9, are encoded in sequence starting at 30h (HEX).
  - The **upper case** alphabetic characters are sequential beginning at 41h.
  - The **lower case** alphabetic characters are sequential beginning at 61h.
  - The first 32 characters (codes 0-1Fh) and 7Fh are control characters.
  - Most keyboards generate the control characters by holding down a control key (CTRL) and simultaneously pressing an alphabetic character key.

EXTENDED ASCII CHARACTERS								
DEC	HEX	CHARACTER	DEC	HEX	CHARACTER	DEC	HEX	CHARACTER
128	0x80	€	171	0xAB	«	214	0xD6	Ö
129	0x81		172	0xAC	¬	215	0xD7	×
130	0x82	‚	173	0xAD		216	0xD8	Ø
131	0x83	ƒ	174	0xAE	®	217	0xD9	Ù
132	0x84	„	175	0xAF	¯	218	0xDA	Ú
133	0x85	…	176	0xB0	°	219	0xDB	Û
134	0x86	†	177	0xB1	±	220	0xDC	Ü
135	0x87	‡	178	0xB2	²	221	0xDD	Ý
136	0x88	ˆ	179	0xB3	³	222	0xDE	Þ
137	0x89	‰	180	0xB4	´	223	0xDF	ß
138	0x8A	Š	181	0xB5	µ	224	0xE0	à
139	0x8B	‹	182	0xB6	¶	225	0xE1	á
140	0x8C	Œ	183	0xB7	·	226	0xE2	â
141	0x8D		184	0xB8	¸	227	0xE3	ã
142	0x8E	Ž	185	0xB9	¹	228	0xE4	ä
143	0x8F		186	0xBA	º	229	0xE5	å
144	0x90		187	0xBB	»	230	0xE6	æ
145	0x91	‘	188	0xBC	¼	231	0xE7	ç
146	0x92	’	189	0xBD	½	232	0xE8	è
147	0x93	“	190	0xBE	¾	233	0xE9	é
148	0x94	”	191	0xBF	¿	234	0xEA	ê
149	0x95	•	192	0xC0	À	235	0xEB	ë
150	0x96	–	193	0xC1	Á	236	0xEC	ì
151	0x97	—	194	0xC2	Â	237	0xED	í
152	0x98	˜	195	0xC3	Ã	238	0xEE	î
153	0x99	™	196	0xC4	Ä	239	0xEF	ï
154	0x9A	š	197	0xC5	Å	240	0xF0	ð
155	0x9B	›	198	0xC6	Æ	241	0xF1	ñ

FIG : Extended or Higher ASCII characters and codes

Applications of IT in different fields

Information Technology is the use of computer systems, storage devices, and any other type of physical device to manage exercise, store, and retrieve all types of data transmitted over electronic lines or electronic data. We can clearly see the growth of information technology in today's world, and the main reason for this growth is the increased use of technology. Today, information technology is a part of almost every organisation, and the reason for this is obvious: the rapid increase in technology use.

Why is information technology required in business and various fields all over the globe?

Information technology enables people in businesses to improve their use of technology, increasing productivity and, as a result, assisting in the growth of the business. As we all know, technology is present everywhere in the world, and its applications are not limited to business.

So, let's take a look at all the applications of Information technology in various aspects and industries around the world.

1. Healthcare

With a simple definition, healthcare is a massive and complex industry. Healthcare can be defined as the provision of services or treatment to people who are ill, either mentally or physically. Information technology has already made significant contributions to the field of healthcare, and advancements are still being made.

- Doctors can now send patients' live health conditions to different specialists via the cloud and get suggestions
- With the use of virtual charts, health professionals can now easily compare health data (X-rays, test results)
- Hospitals can keep a disease registry and publish reports to the government.
- Doctors can send patients E-Prescriptions via email, Whatsapp, or text message.
- Many medical facilities offer Telehealth services, in which patients can communicate with doctors via the internet.

2. Education

The education industry has undergone significant change as a result of advances in information technology. More students are now eager to enroll in schools, owing to the administration's use of cutting-edge technology in the classrooms. Online e-libraries where students can download ebooks and resources:

- Online exams where students can write exams and submit documents to mentors.
- Ready-to-use resources that enable students to learn any subject at any time and in any location.
- An online ranking system allows students to compete with students from all over the world.

3. Communications

The advancement of information technology has made the world a smaller place, and the entire world is now connected. Data can now be shared anywhere in the world, regardless of geographical location. Many organisations have been able to transfer terabytes of data in seconds, increasing not only productivity but also saving a significant amount of time and manpower.

4. Employment

Every day, we could see hundreds of job openings from all over the world. Software engineers, data scientists, cloud analysts, designers, and developers are all involved in data management in some way. We would never see the above positions if it weren't for information technology.

5. Security

Because the entire data is stored on the cloud, and physical devices, and there is a lot of data transferring involved, it is critical to safeguard all of the data.IT aids in the secure reading and transfer of data via risk-free network channels. IT also aids in data security through the use of passwords, facial recognition, and fingerprint recognition.

6. Governance

The concept of E-Governance is currently transforming the lives of millions of people all over the world. The digitalisation of government activities has made the administration more accountable and responsive to societal issues. Even remote areas with no internet access are being recognised by the government, and authorities are providing the necessary resources to the people.

7. Entertainment

Information Technology has brought about significant changes in all of our lifestyles. IT has introduced a plethora of new entertainment options into our lives. People can now watch their favourite shows and movies and listen to music via cable or wirelessly. People can now watch 3D and even 7D movies, special audio systems, and even access global radio channels thanks to technological advancements.

Conclusion:

These are only a few of the applications of information technology; however, if we look closely, the applications of IT are limitless. The use of information technology is growing at a rapid pace, and the main reason for this is an increase in the use of technology. Based on these, we can all agree that information technology has changed the world for the better.