Unit I: Computer Fundamentals
I) Introduction to Computers

What is a computer?

A computer is an electronic data processing device, capable of accepting data, applying a prescribed set of instructions to the data, and displaying the processed data in a desired manner as output.

Characteristics of a Computer
- Automatic
- Speed and accuracy of computing
- Diligence
- Power of remembering (Mass Storage)
- Versatility

Basic Computer Organization
Almost all computer systems perform following basic five operations
1. Inputting
2. Storing
3. Processing
4. Outputting
5. Controlling

The internal architecture of computers differs from one computer model to another; however, the basic organization remains the same for all computers.
A BLOCK DIAGRAM is shown below which displays the five building blocks (functional units) of a computer. These five units correspond to the five basic operations performed by all computers.

**Applications of Computers**

Computers have their application or utility everywhere. We find their applications in almost every sphere of life—particularly in fields where computations are required to be done at a very fast speed and where data is so complicated that the human brain finds it difficult to cope up with.

Computer now-a-days are being used almost in every department to do the work at a greater speed and accuracy. They can keep the record of all the employees and prepare their pay bill in a matter of minutes every month. They can keep automatic checks on the stock of a particular item. Some of the prominent areas of computer applications are:

**In Education:** Computers have proved to be excellent teachers. They can possess the knowledge given to them by the experts and teach you with all the patience in the world. You may like to repeat a lesson hundred times, go ahead, you may get tired but the computer will keep on teaching you. Computer
based instructions (CBI) and Computer Aided Learning (CAL) are common tools used for teaching. Computer based encyclopaedia such as Britannica provide you enormous amount of information on anything.

**In Industry:** Computers are finding their greatest use in factories and industries of all kinds. They have taken over the work ranging from monotonous and risky jobs like welding to highly complex jobs such as process control. Drills, saws and entire assembly lines can be computerized. Moreover, quality control tests and the manufacturing of products, which require a lot of refinement, are done with the help of computers. Not only has this, Thermal Power Plants, Oil refineries and chemical industries fully depended on computerized control systems because in such industries the lag between two major events may be just a fraction of a second.

**In Tourism:** Hotels use computers to speed up billing and checkout the availability of rooms. So is the case with railways and airline reservations for booking tickets. Architects can display their scale models on a computer and study them from various angles and perspectives. Structural problems can now be solved quickly and accurately.

**In Banks:** Banks also have started using computers extensively. Terminals are provided in the branch and the main computer is located centrally. This enables the branches to use the central computer system for information on things such as current balance, deposits, overdrafts, interest charges, etc. MICR encoded cheques can be read and sorted out with a speed of 3000 cheques per minute by computers as compared to hours taken by manual sorting. Electronic funds transfer (EFT) allows a person to transfer funds through computer signals over wires and telephone lines making the work possible in a very short time.

**In Transportation:** Today computers have made it possible for planes to land in foggy and stormy atmosphere also. The aircraft has a variety of sensors, which measure the plane’s altitude, position, speed, height and direction. Computer use all this information to keep the plane flying in the right direction. In fact, the Auto–pilot feature has made the work of pilot much easy.

**In Entertainment:** Computers are also great entertainers. Many computer games are available which are like the traditional games like chess, football, cricket, etc. Dungeons and dragons provide the opportunity to test your memory and ability to think. Other games like Braino and Volcano test your knowledge.

**Applications of Computer in the field of Education:**
Computer-based learning

Computer-based learning, sometimes abbreviated to CBL, refers to the use of computers as a key component of the educational environment. While this can refer to the use of computers in a classroom, the term more broadly refers to a structured environment in which computers are used for teaching purposes.

Cassandra B. Whyte researched about the ever increasing role that computers would play in higher education. This evolution, to include computer-supported collaborative learning, in addition to data management, has been realized. The type of computers has changed over the years from cumbersome, slow devices taking up much space in the classroom, home, and office to laptops and handheld devices that are more portable in form and size and this minimalization of technology devices will continue.

Computer-based training

Computer-based trainings (CBTs) are self-paced learning activities accessible via a computer or handheld device. CBTs typically present content in a linear fashion, much like reading an online book or manual. For this reason they are often used to teach static processes, such as using software or completing mathematical equations. The term Computer-Based Training is often used interchangeably with Web-based training (WBT) with the primary difference being the delivery method. Where CBTs are typically delivered via CD-ROM, WBTs are delivered via the Internet using a web browser. Assessing learning in a CBT usually comes in form of multiple choice questions, or other assessments that can be easily scored by a computer such as drag-and-drop, radio button, simulation or other interactive means. Assessments are easily scored and recorded via online software, providing immediate end-user feedback and completion status. Users are often able to print completion records in the form of certificates.

CBTs provide learning stimulus beyond traditional learning methodology from textbook, manual, or classroom-based instruction. For example, CBTs offer user-friendly solutions for satisfying continuing education requirements. Instead of limiting students to attending courses or reading printed manuals, students are able to acquire knowledge and skills through methods that are much more conducive to individual learning preferences.[citation needed] For example, CBTs offer visual learning benefits through animation or video, not typically offered by any other means.

CBTs can be a good alternative to printed learning materials since rich media, including videos or animations, can easily be embedded to enhance the learning. Another advantage to CBTs is that they can be easily distributed to a wide audience at a relatively low cost once the initial development is completed.

However, CBTs pose some learning challenges as well. Typically the creation of effective CBTs requires enormous resources. The software for developing CBTs (such as Flash or Adobe Director) is often more complex than a subject matter expert or teacher is able to use. In addition, the lack of human interaction can limit both the type of content that can be presented as well as the type of assessment that can be performed. Many learning organizations
are beginning to use smaller CBT/WBT activities as part of a broader online learning program which may include online discussion or other interactive elements.

**Computer-supported collaborative learning (CSCL)**

Computer-supported collaborative learning (CSCL) is one of the most promising innovations to improve teaching and learning with the help of modern information and communication technology. Most recent developments in CSCL have been called E-Learning 2.0, but the concept of collaborative or group learning whereby instructional methods are designed to encourage or require students to work together on learning tasks has existed much longer. It is widely agreed to distinguish collaborative learning from the traditional 'direct transfer' model in which the instructor is assumed to be the distributor of knowledge and skills, which is often given the neologism E-Learning 1.0, even though this direct transfer method most accurately reflects Computer-Based Learning systems (CBL).

Locus of Control remains an important consideration in successful engagement of E-learners. According to the work of Cassandra B. Whyte, the continuing attention to aspects of motivation and success in regard to E-learning should be kept in context and concert with other educational efforts. Information about motivational tendencies can help educators, psychologists, and technologists develop insights to help students perform better academically.
II) Parts of a computer

If you use a desktop computer, you might already know that there isn’t any single part called the "computer." A computer is really a system of many parts working together. The physical parts, which you can see and touch, are collectively called hardware. Software, on the other hand, refers to the instructions, or programs, that tell the hardware what to do.

The illustration below shows the most common hardware in a desktop computer system. Your system may look a little different, but it probably has most of these parts. A laptop computer has similar parts but combines them into a single notebook-sized package.
Let's take a look at each of these parts.

**System unit**

The system unit is the core of a computer system. Inside this box are many electronic components that process information. The most important of these components is the **central processing unit (CPU)**, or microprocessor, which acts as the "brain" of your computer. Another component is **random access memory (RAM)**, which temporarily stores information that the CPU uses while the computer is on. The information stored in RAM is erased when the computer is turned off. Almost every other part of your computer connects to the system unit using cables. The cables plug into specific ports (openings), typically on the back of the system unit. Hardware that is not part of the system unit is sometimes called a peripheral device or device.
Storage

Your computer has one or more disk drives—devices that store information on a metal or plastic disk. The disk preserves the information even when your computer is turned off.

**Hard disk drive**

Your computer's hard disk drive stores information on a hard disk, a rigid platter or stack of platters with a magnetic surface. Because hard disks can hold massive amounts of information, they usually serve as your computer's primary means of storage, holding almost all of your programs and files. The hard disk drive is normally located inside the system unit.

![Hard disk drive](image)

**CD and DVD drives**
Nearly all computers today come equipped with a CD or DVD drive, usually located on the front of the system unit. CD drives use lasers to read (retrieve) data from a CD, and many CD drives can also write (record) data onto CDs. If you have a recordable disk drive, you can store copies of your files on blank CDs. You can also use a CD drive to play music CDs on your computer.

![Compact Disk](https://via.placeholder.com/150)

DVD drives can do everything that CD drives can, plus read DVDs. If you have a DVD drive, you can watch movies on your computer. Many DVD drives can record data onto blank DVDs.

**Floppy disk drive**

Floppy disk drives store information on floppy disks, also called floppies or diskettes. Compared to CDs and DVDs, floppy disks can store only a small amount of data. They also retrieve information more slowly and are more prone to damage. For these reasons, floppy disk drives are less popular than they used to be, although some computers still include them.
Why are floppy disks “floppy”? Even though the outside is made of hard plastic, that's just the sleeve. The disk inside is made of a thin, flexible vinyl material.

Mouse

A mouse is a small device used to point to and select items on your computer screen. Although mice come in many shapes, the typical mouse does look a bit like an actual mouse. It's small, oblong, and connected to the system unit by a long wire that resembles a tail. Some newer mice are wireless.
A mouse usually has two buttons: a primary button (usually the left button) and a secondary button (usually the right button). Many mice also have a wheel between the two buttons, which allows you to scroll smoothly through screens of information.

When you move the mouse with your hand, a pointer on your screen moves in the same direction. (The pointer's appearance might change depending on where it's positioned on your screen.) When you want to select an item, you point to the item and then click (press and release) the primary button. Pointing and clicking with your mouse is the main way to interact with your computer.

**Keyboard**

A keyboard is used mainly for typing text into your computer. Like the keyboard on a typewriter, it has keys for letters and numbers, but it also has special keys:

- The function keys, found on the top row, perform different functions depending on where they are used.
- The numeric keypad, located on the right side of most keyboards, allows you to enter numbers quickly.
- The navigation keys, such as the arrow keys, allow you to move your position within a document or webpage.
Monitor

A monitor displays information in visual form, using text and graphics. The portion of the monitor that displays the information is called the screen. Like a television screen, a computer screen can show still or moving pictures.

There are two basic types of monitors: CRT (cathode ray tube) monitors and LCD (liquid crystal display) monitors. Both types produce sharp images, but LCD monitors have the advantage of being much thinner and lighter. CRT monitors, however, are generally more affordable.

Printer

A printer transfers data from a computer onto paper. You don't need a printer to use your computer, but having one allows you to print e-mail, cards, invitations, announcements, and other materials. Many people also like being able to print their own photos at home.
The two main types of printers are inkjet printers and laser printers. Inkjet printers are the most popular printers for the home. They can print in black and white or in full color and can produce high-quality photographs when used with special paper. Laser printers are faster and generally better able to handle heavy use.

Speakers

Speakers are used to play sound. They may be built into the system unit or connected with cables. Speakers allow you to listen to music and hear sound effects from your computer.
Modem

To connect your computer to the Internet, you need a modem. A modem is a device that sends and receives computer information over a telephone line or high-speed cable. Modems are sometimes built into the system unit, but higher-speed modems are usually separate components.
**Types of Memory**

There are two kinds of computer memory: primary and secondary.

**Primary memory (or Main memory)**: Computer main memory comes in two principal varieties: random-access memory or RAM and read-only memory or ROM. RAM can be read and written to anytime the CPU commands it, but ROM is pre-loaded with data and software that never changes, therefore the CPU can only read from it. ROM is typically used to store the computer's initial start-up instructions. In general, the contents of RAM are erased when the power to the computer is turned off— it is volatile, but ROM retains its data indefinitely.

**Secondary storage (also known as external memory or auxiliary storage)**, differs from primary storage in that it is not directly accessible by the CPU. The computer usually uses its input/output channels to access secondary storage and transfers the desired data using intermediate area in primary storage. Secondary storage does not lose the data when the device is powered down—it is non-volatile. In modern computers, hard disk drives are usually used as secondary storage. The time taken to access a given byte of information stored on a hard disk is typically a few thousandths of a second, or milliseconds. By contrast, the time taken to access a given byte of information stored in random access memory is measured in billionths of a second, or nanoseconds. This illustrates the significant access-time difference which distinguishes solid-state memory from rotating magnetic storage devices: hard disks are typically about a million times slower than memory. Rotating optical storage devices, such as CD and DVD drives, have even longer access times. Some other examples of secondary storage technologies are: flash memory (e.g. USB flash drives or pen drives), floppy disks, magnetic tape, etc.
Classification of Computers by Size

Microcomputers (Personal computers)
Microcomputers are the most common type of computers used by people today, whether in a workplace, at school or on the desk at home. The term “microcomputer” was introduced with the advent of single chip microprocessors. These computers include:

- **Desktop computers** – A case and a display, put under and on a desk.
- **Game consoles** – Fixed computers specialized for entertainment purposes (video games).
- **Laptops, notebook computers and Palmtop computers** – Portable and all in one case
- **Tablet computer** – Like laptops, but with a touch-screen, sometimes entirely replacing the physical keyboard.
- **Smartphones, smartbooks and PDAs (personal digital assistants)** – Small handheld computers with limited hardware.

Minicomputers (Midrange computers)
A minicomputer is a class of multi-user computers that lies in the middle range of the computing spectrum, in between the smallest multi-user systems (mainframe computers) and the largest single-user systems (microcomputers or personal computers). The contemporary term for this class of system is midrange computer, such as the higher-end SPARC, POWER and Itanium-based systems from Oracle Corporation, IBM and Hewlett-Packard.

Mainframe computers
The term mainframe computer was created to distinguish the traditional, large, institutional computer intended to service multiple users from the smaller, single user machines. These computers are capable of handling and processing very large amounts of data quickly. Mainframe computers are used in large institutions such as government, banks and large corporations. Its measured in MIPS (Million instructions per second) and responds up to 100s of million users at one time.

Supercomputer
A supercomputer is focused on performing tasks involving intense numerical calculations such as weather forecasting, fluid dynamics, nuclear simulations, theoretical astrophysics, and complex scientific computations. Supercomputer processing speeds are measured in floating point operations per second or FLOPS. An example of a floating point operation is the calculation of mathematical equations in real numbers. In terms of computational capability, memory size and speed, I/O technology, and topological issues such as bandwidth and latency,
supercomputers are the most powerful, are very expensive, and not cost-effective just to perform batch or transaction processing. Transaction processing is handled by less powerful computers such as server computers or mainframes.
### Computer Generations

<table>
<thead>
<tr>
<th>Generation (Period)</th>
<th>Key hardware Technologies</th>
<th>Key software technologies</th>
<th>Key characteristics</th>
<th>Some representative systems</th>
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<tbody>
<tr>
<td>First (1942-1955)</td>
<td>Vacuum tubes; electromagnetic relay memory; punched cards secondary storage</td>
<td>Machine and assembly languages; stored program concept; mostly scientific applications</td>
<td>Bulky in size; highly unreliable; limited commercial use; commercial production difficult and costly; difficult to use</td>
<td>ENIAC, EDVAC, EDSAC, UNIVAC 1, IBM 701</td>
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<td>Second (1955-1964)</td>
<td>Transistors; magnetic cores memory; magnetic tapes and disks secondary storage</td>
<td>Batch operating system; high-level programming languages; scientific and commercial applications</td>
<td>Faster, smaller, more reliable and easier to program than previous generation systems; commercial production was still difficult and costly</td>
<td>Honeywell 400, IBM 7030, CDC 1604, UNIVAC 1ARC</td>
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<tr>
<td>Third (1964-1975)</td>
<td>ICs with SSI and MSI technologies; larger magnetic cores memory; larger capacity disks and magnetic tapes secondary storage; minicomputers</td>
<td>Timesharing operating system; standardization of high-level programming languages; unbundling of software from hardware</td>
<td>Faster, smaller, more reliable, easier and cheaper to produce commercially, easier to use, and easier to upgrade than previous generation systems; scientific, commercial and interactive on-line applications</td>
<td>IBM 360/370, PDP-8, PDP-11, CDC 6600</td>
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<tr>
<td>Fourth (1975-1989)</td>
<td>ICs with VLSI technology; microprocessors; semiconductor memory; larger capacity hard disks as in-built secondary storage; magnetic tapes and floppy disks as portable storage media; personal computers; spread of high-speed computer networks</td>
<td>Operating systems for PCs; GUI; multiple windows on a single terminal screen; UNIX operating system; C programming language; PC-based applications; network-based applications</td>
<td>Small, affordable, reliable, and easy to use PCs; more powerful and reliable mainframe systems; totally general purpose machines; easier to produce commercially</td>
<td>IBM PC and its clones, Apple II, TRS-80, VAX 9000, CRAY-1, CRAY-2, CRAY-X/MP</td>
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<tr>
<td>Fifth (1989-Present)</td>
<td>ICs with ULSI technology; larger capacity main memory; larger capacity hard disks; optical disks as portable read-only storage media; notebook computers; powerful desktop PCs and workstations; very powerful mainframes; internet</td>
<td>World Wide Web; multimedia applications; internet-based applications</td>
<td>Portable computers; more powerful, cheaper, reliable, and easier to use desktop machines; very powerful mainframes; very high uptime due to hot-pluggable components; totally general purpose machines; easier to produce commercially</td>
<td>IBM notebooks, Pentium PCs, SUN Workstations, IBM SP/2, SGI Origin 2000, PARAM 10000</td>
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*Figure 1.2. Computer generations – A summary.*