INTRODUCTION TO COMPUTER

The term 'Computer' was first introduced in 1640 and referred to as 'one who calculates'. It was derived from the Latin word 'computer', which meant 'to calculate'. In 1897, it was known as the 'calculating machine'. Later in 1945, the term 'computer' was introduced as 'programmable digital electronic computer, which is now called a 'computer'.

In the modern era, computers are an essential part of our everyday existence. That means computers are present in almost every field, making our day-to-day tasks easier and faster. Nowadays, computers can be seen in banks, shops, schools, hospitals, railways, and many more places, including our home.

WHAT IS COMPUTER?

A computer is an electronic programable machine which takes instructions as an input process them and give information as an output.

It is also defined as **"a programmable electronic device that takes data, perform instructed arithmetic and logical operations, and gives the output"**.
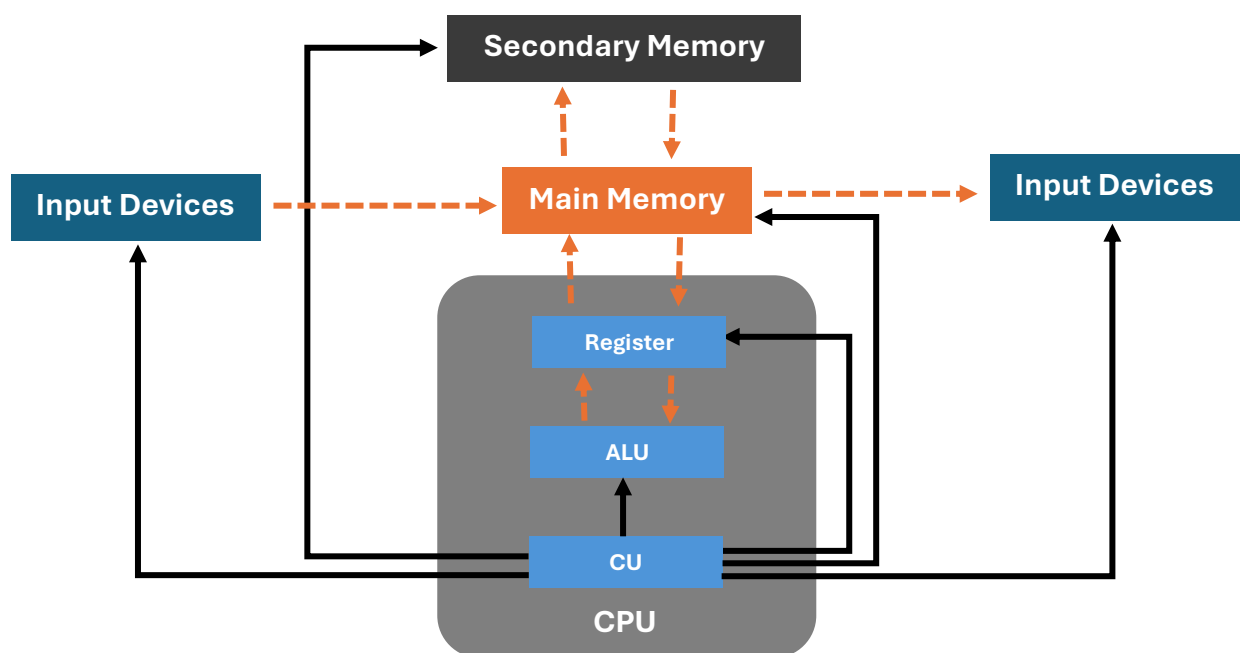

Fig: 1.1 – Computer Structure

Features of Computer

1. Speed

Computers are incredibly fast and can perform millions, even billions, of instructions per second. The **speed** of a computer is due to the processing power of its **Central Processing Unit (CPU)**. This allows computers to execute tasks quickly, from simple calculations to complex simulations. For example, in scientific research, computers can model weather patterns, perform calculations, and process large datasets in a fraction of the time it would take a human to do manually. The rapid execution of tasks makes computers indispensable in fields like data analysis, finance, engineering, and gaming, where time is critical.

2. Accuracy

One of the most notable features of computers is their **accuracy**. When properly programmed, computers will execute instructions without making errors. Unlike humans, who can be prone to mistakes due to fatigue or distraction, computers consistently perform tasks with 100% accuracy. Whether it's performing complex mathematical computations or displaying data, the results will always be correct as long as the input data and instructions are valid. This makes computers ideal for critical tasks like financial transactions, scientific calculations, and medical diagnostics, where even the smallest error can have serious consequences.

3. Diligence

Diligence refers to a computer's ability to perform the same task repeatedly without fatigue or loss of focus. Computers can run programs or execute commands continuously for long periods of time, day and night, without needing rest or breaks. Whether it's running a server, processing data in a factory, or performing backup operations, computers can work diligently without slowing down, unlike humans who may tire or lose concentration after prolonged effort.

4. Storage

Storage is another essential feature of computers. They can store vast amounts of data, whether it's documents, images, software programs, or multimedia files. Modern computers are equipped with large **hard drives (HDDs)** or **solid-state drives (SSDs)** that offer significant storage space, allowing users to keep everything from system files to personal media. Additionally, with the rise of **cloud storage**, users can store even more data remotely and access it from any device with an internet connection. The large storage capacity of computers is one of the reasons they are so versatile, enabling them to handle diverse data needs in personal, academic, and professional environments.

5. Consistency

Consistency is a feature that allows computers to operate in a predictable manner. Computers always produce the same result when given the same input and instructions, ensuring reliability across tasks. Whether it's a simple calculation or a complex machine learning algorithm, a computer will follow the same set of rules every time it operates. This consistency is crucial in many industries where reliable, repeatable results are necessary, such as in manufacturing, software development, and scientific research. Unlike humans, who may experience variability in performance, computers remain consistent and dependable in their operations.

6. Memory

Computers require **memory** to function, just like humans use memory to recall information and perform tasks. **RAM (Random Access Memory)** is the short-term memory used by the CPU to store data that is actively being processed, while **secondary storage** (like hard drives or SSDs) holds long-term data, such as software, documents, and media files. The amount and speed of memory affect the computer's overall performance. More memory allows a computer to handle larger programs and datasets, while faster memory speeds up access to frequently used data. Adequate memory is essential for smooth operation, especially when running multiple programs or handling complex tasks.

7. Versatility

One of the greatest strengths of computers is their **versatility**. They can be used for a wide variety of tasks, from writing documents to playing games, analyzing data, or designing graphics. With the proper software and hardware, a computer can perform almost any function imaginable. This flexibility allows computers to be used in numerous industries, from healthcare to entertainment, education, and business. Whether you're using a computer to communicate with others, create digital artwork, run simulations, or develop new technologies, the versatility of computers makes them indispensable in modern life.

8. Automation

Automation is a key feature of computers that allows them to perform tasks without human intervention. Computers can be programmed to execute repetitive tasks, saving time and reducing the potential for human error. For example, computers can automate processes like data backups, software updates, or managing inventory in a warehouse. In industrial settings, computers control machines to automate manufacturing lines, increasing productivity and efficiency. Automation also extends to software, where tasks like sending emails, processing transactions, or generating reports can be set up to run automatically, streamlining workflows and reducing manual labor.

Disadvantages of Computer

1. Dependence on Technology

Over-reliance on computers can lead to a loss of essential skills, such as mental arithmetic or handwriting. People may also become too dependent on computers for decision-making and problem-solving, making them less self-sufficient in some areas.

2. Job Displacement

Automation powered by computers has led to job displacement in certain sectors. Routine tasks that were once performed by humans, such as data entry or manufacturing, are now automated, reducing the need for human labor. This can lead to unemployment and the need for workers to acquire new skills.

3. Security Risks

Computers are vulnerable to cyberattacks, viruses, malware, and data breaches. Personal and sensitive data stored on computers can be stolen or damaged if proper security measures are not in place. Hacking, phishing, and other malicious activities can compromise privacy and security.

4. Health Issues

Prolonged use of computers can lead to a range of health problems, such as eye strain, headaches, and repetitive strain injuries (RSI) from constant keyboard and mouse use. Sedentary behavior, often associated with extended computer use, can also contribute to obesity and other health issues like poor posture and back pain.

5. Environmental Impact

The production, use, and disposal of computers contribute to electronic waste (e-waste) and pollution. Computers require energy to operate and generate heat, leading to environmental concerns. The mining of minerals for components like semiconductors and batteries also has negative environmental consequences.

6. Social Isolation

Overuse of computers for entertainment or work can lead to **social isolation**. Spending excessive time on the internet, social media, or gaming can cause people to neglect in-person relationships and personal interactions, which can affect mental health and emotional well-being.

7. Cost

While computers can offer numerous advantages, the initial purchase price of high-performance computers or specialized systems can be expensive. Additionally, the cost of maintaining and upgrading software, hardware, and security measures can add to the financial burden for individuals and organizations.

8. Software and Hardware Compatibility Issues

Computers often face compatibility issues between different software programs or hardware components. Users may experience problems when trying to run certain software on older systems or when attempting to integrate new hardware with existing devices. This can lead to frustration and inefficiency.

Generations of Computer

1. 1st Generation (1940s – 1950s): Vacuum Tubes

The first generation of computers was defined by the use of vacuum tubes as the primary technology for circuit design. These early computers, such as the ENIAC (Electronic Numerical Integrator and Computer), were large, bulky, and extremely power-hungry. They were primarily used for mathematical calculations, and their input/output was managed using punched cards and paper tape. While these machines were groundbreaking for their time, they had several limitations. They were slow, took up massive amounts of space, and were prone to frequent malfunctions due to the vacuum tubes overheating. These computers could only handle one task at a time and required significant maintenance. Nevertheless, the 1st generation marked the beginning of computing technology, laying the groundwork for future advancements.

Fig 1.2 - Vacuum Tube

2. 2nd Generation (1950s – 1960s): Transistors

The transition to the second generation of computers occurred when vacuum tubes were replaced by transistors, which were smaller, more efficient, and more reliable. Transistors made it possible to build more compact, faster, and energy-efficient computers. This period also saw the introduction of magnetic core memory, which was used for data storage, making the machines more reliable. High-level programming languages such as FORTRAN and COBOL were developed, making it easier for programmers to write complex software. Notable examples of second-generation computers include the IBM 7090 and the CDC 1604. While still relatively large by today's standards, these computers were much faster and less prone to failure compared to their predecessors, offering the first real glimpse of a scalable computer that could serve different industries.
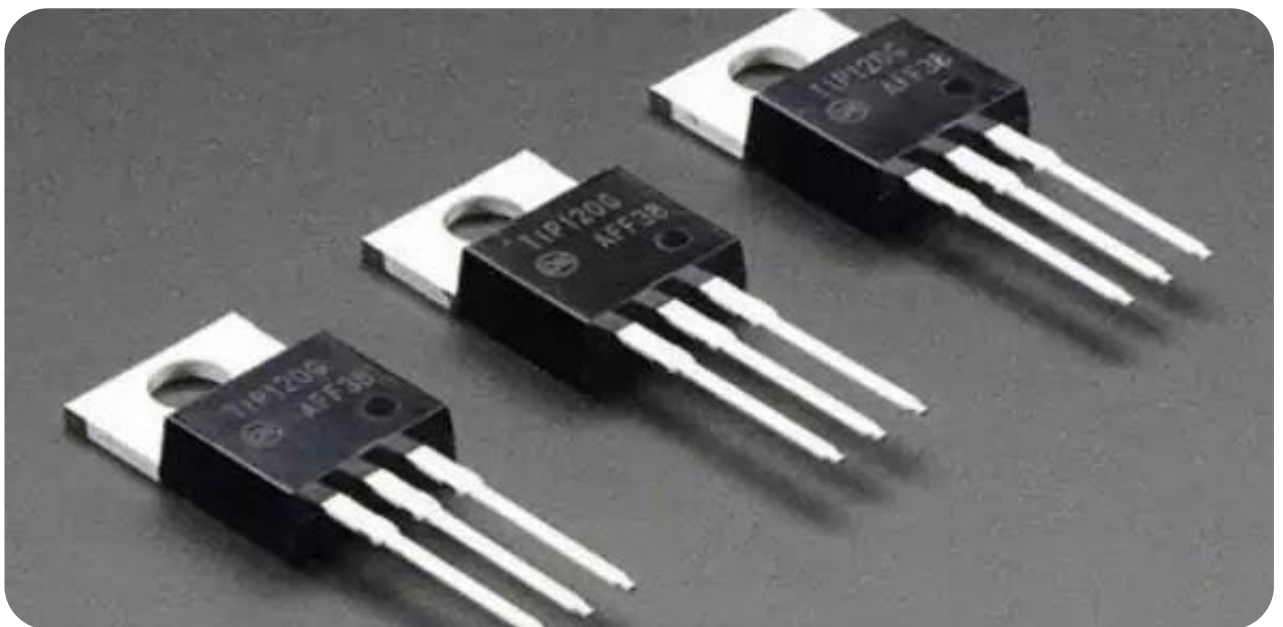

Fig 1.3 - Transistors

3. 3rd Generation (1960s – 1970s): Integrated Circuits

The third generation of computers brought the development of integrated circuits (ICs), which allowed multiple transistors to be placed on a single chip. This development drastically reduced the size of computers while increasing their power and efficiency. Computers became smaller, more affordable, and capable of handling more complex tasks. The IBM 360 series, for example, became one of the most widely used computers during this era, offering a range of functionalities in a smaller package. The advent of keyboards, monitors, and operating systems transformed how people interacted with computers, making them more accessible and user-friendly. This generation also saw the emergence of multiprogramming, allowing computers to run multiple programs simultaneously. Although the computers were more powerful than previous generations, they were still primarily used by large organizations, governments, and research institutions.
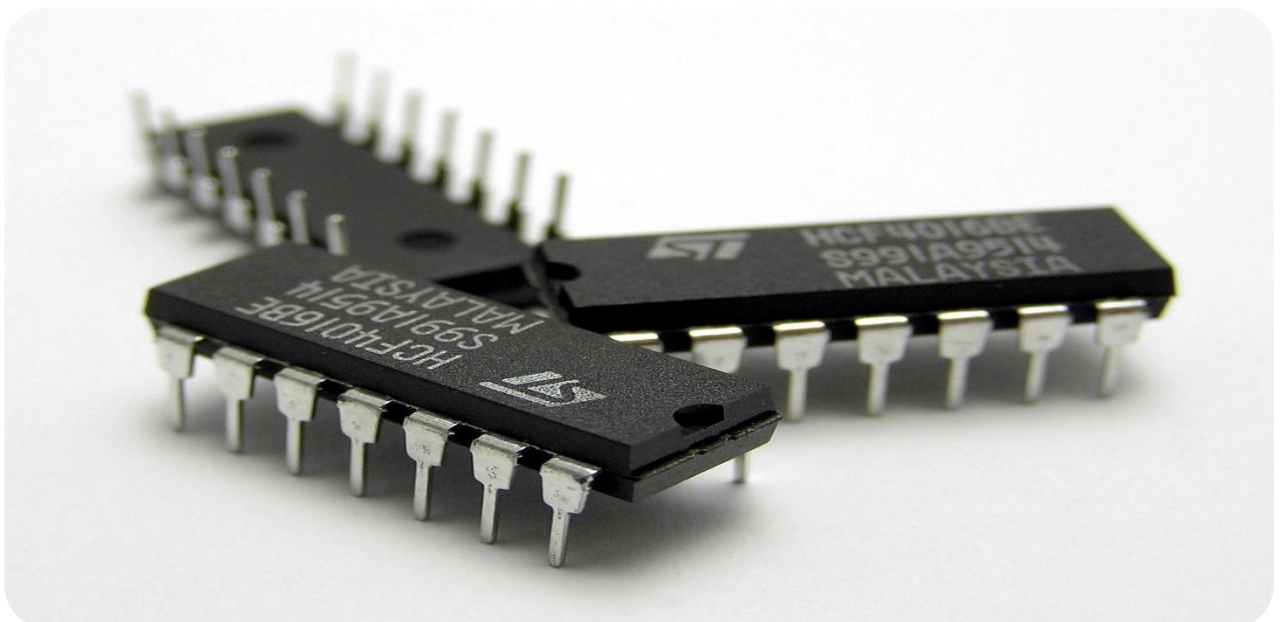

Fig 1.4 – Integrated Circuits

4. 4th Generation (1970s – 1990s): Microprocessors

The fourth generation of computers is defined by the invention of the microprocessor, a single chip that could handle all the processing tasks that had previously required multiple components. This breakthrough revolutionized computing, as it allowed for the creation of personal computers (PCs). The introduction of the Intel 4004, the first microprocessor, in 1971 made it possible to build smaller, cheaper, and more efficient computers. With the IBM PC and Apple II, personal computers became available to businesses and homes, giving rise to a new era in computing. This generation also saw the development of graphical user interfaces (GUIs) and the mouse as input devices, making computers more accessible to people with little to no technical expertise. The 4th generation marked the dawn of the information age, where computers were no longer reserved for large organizations but were widely available for personal and professional use.

Fig 1.5 - Microprocessor

5. 5th Generation (1990s – Present): Biochip

The **fifth generation** of computers is characterized by the development of **artificial intelligence (AI)**, **machine learning**, and the use of **quantum computing**. These advancements have enabled computers to not only perform calculations but also simulate human reasoning, learn from experience, and process vast amounts of unstructured data. The use of AI has already transformed industries such as healthcare, automotive, and customer service through the development of technologies like **self-driving cars**, **voice assistants**, and **recommendation systems**. Supercomputers, like those used in climate modeling and genetic research, are now capable of solving problems that were previously considered unsolvable. Additionally, **cloud computing** has allowed individuals and businesses to store and access data over the internet, further increasing the accessibility and power of computers. While **quantum computing** is still in its infancy, it promises to revolutionize areas like cryptography and problem-solving, making the potential of the fifth generation vast and groundbreaking.
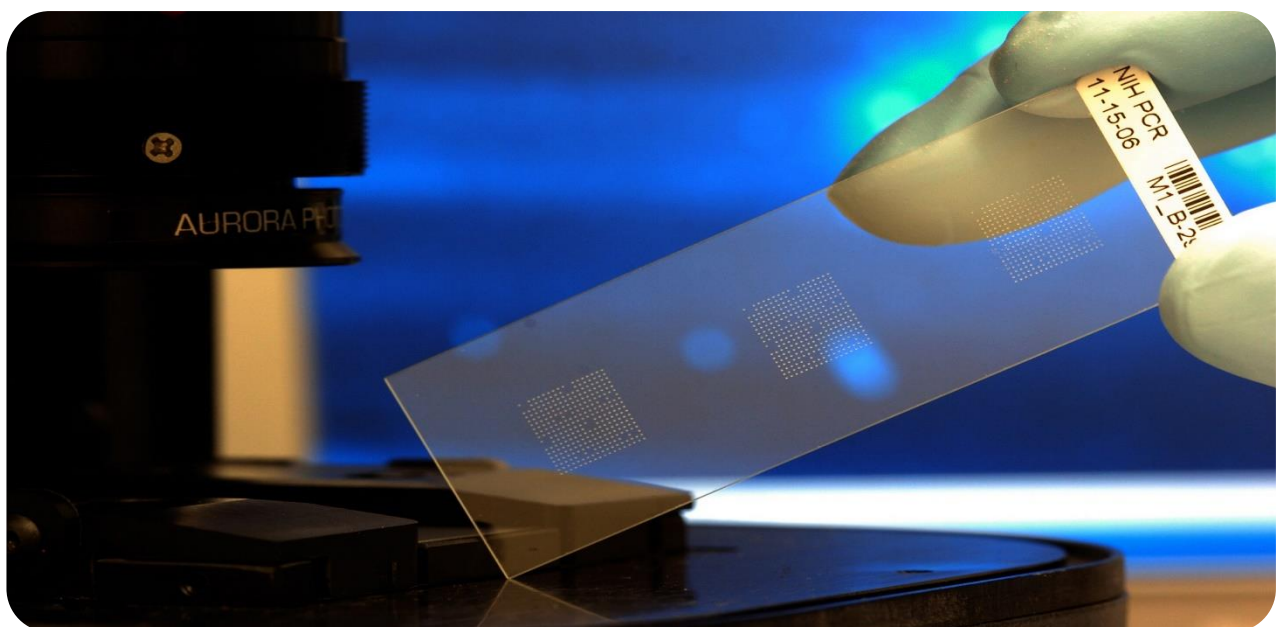

Fig 1.6 – Biochip