Bachelor in Computer Application

Semester-I

FUNDAMENTALS OF COMPUTER AND ITS APPLICATIONS

BCA - 101

Unit-1

Q-1:What is Computer? Explain Computer System concept. Also explain its Capabilities and limitations.

A computer is an electronic device that can be programmed to accept data (input) process it and generate result (output). A computer along with additional hardware and software together is called a computer system.

A computer is system of hardware devices organized according to the following system functions.
 Input: The input devices of a computer system include keyboards, touch screens, pens, electronic mice, optical scanners, and so on.

 Processing: The central processing unit (CPU) is the main processing component of a computer system. (In microcomputers, it is the main microprocessor.) In particular, the electronic circuits of the arithmetic-logic unit one of the CPU's major components perform the arithmetic and logic functions required in computer processing.

 Output: The output devices of a computer system include video display units, printers, audio response units, and so on, they convert electronic information produced by the computer system into human intelligible form for presentation to end users.

 Storage: The storage function of a computer system takes place in the storage circuits of the computer's primary storage unit, or memory, and in secondary storage devices such as magnetic disk and tape units. These devices store data and program instructions needed for processing.

 Control: The control unit of the CPU is the control component of a computer system. Its circuits interpret computer program instructions and transmit directions to the other components of the computer system.

Characteristics/Capabilities of Computer System
Capabilities of a computer system are the qualities of the computer that put it in a positive light and make the user experience more efficient.

 Speed: Speed is the amount of time taken by the computer in accomplishing a task of an operation. The time taken by a computer to perform a particular task is far less than that taken by than a human being. Different computers are classified on the basis of their speed by comparing their MIPS (Million Instructions Per Second).

 Accuracy: Computers perform calculations with 100% accuracy. Errors may occur due to data inconsistency or inaccuracy.

 Reliability: Reliability is the quality due to which the user can stay dependable on the computer. Computers systems are well-adjusted to do repetitive tasks. They never get tired, bored or fatigued. Hence, they are a lot reliable than humans. Still, there can be failures of a computer system due to internal and external reasons.

 Adaptability: Adaptability of computer system means the quality of it to complete a different type of tasks: simple as well as complex. Computers are normally versatile unless designed for a specific operation. Overall, a daily purpose computer is used in any area of application: business, industry, scientific, statistical, technological and so on.
 Storage: It refers to the capacity of a computer to store data and programs. Storage is done in storage media such as CDs, Floppies, DVDs, RAM (Random Access Memory), ROM (Read Only Memory).

Limitations of Computer Systems

Limitations are the drawbacks of the computer system in which humans outperform them.
 Lack of common-sense: This is one of the major limitations of computer systems. No matter how efficient, fast and reliable computer systems might be but yet do not have any common sense because no full-proof algorithm has been designed to programme logic into them. As computers function based on the stored programme(s), they simply lack common sense.

 Zero IQ: Another of the limitations of computer systems is that they have zero Intelligence Quotient (IQ). They are unable to see and think the actions to perform in a particular situation unless that situation is already programmed into them. Computers are programmable to complete each and every task, however small it may be.

 Lack of Decision-making: Decision-making is a complicated process involving information, knowledge, intelligence, wisdom, and ability to judge. The computer system does not have the ability to make decisions on their own because they do not possess all the essentials of decision-making.

Q-2: What is the history of the development of computers and its Generations. Explain in brief.

History of the development of Computers

People used sticks, stones, and bones as counting tools before computers were invented. More computing devices were produced as technology
advanced and the human intellect improved over time. Let us look at a few of the early-age computing devices used by mankind.

Abacus

Abacus was invented by the Chinese around 4000 years ago. It's a wooden rack with metal rods with beads attached to them. The abacus operator
moves the beads according to certain guidelines to complete arithmetic computations.

Napier's Bone

John Napier devised Napier's Bones, a manually operated calculating apparatus. For calculating, this instrument used 9 separate ivory strips (bones)
marked with numerals to multiply and divide. It was also the first machine to calculate using the decimal point system.

Pascaline

Pascaline was invented in 1642 by Biaise Pascal, a French mathematician and philosopher. It is thought to be the first mechanical and automated calculator. It was a wooden box with gears and wheels inside.

Stepped Reckoner or Leibniz wheel

In 1673, a German mathematician-philosopher named Gottfried Wilhelm Leibniz improved on Pascal's invention to create this apparatus. It was a digital mechanical calculator known as the stepped reckoner because it used fluted drums instead of gears.

Difference Engine

In the early 1820s, Charles Babbage created the Difference Engine. It was a mechanical computer that could do basic computations. It was a steam powered calculating machine used to solve numerical tables such as logarithmic tables.

Analytical Engine

Charles Babbage created another calculating machine, the Analytical Engine, in 1830. It was a mechanical computer that took input from punch cards. It was capable of solving any mathematical problem and storing data in an indefinite memory.

Tabulating machine

An American Statistician – Herman Hollerith invented this machine in the year 1890. Tabulating Machine was a punch card-based mechanical tabulator. It could compute statistics and record or sort data or information. Hollerith began manufacturing these machines in his company, which ultimately became International Business Machines (IBM) in 1924.

Differential Analyzer

Vannevar Bush introduced the first electrical computer, the Differential Analyzer, in 1930. This machine is made up of vacuum tubes that switch electrical impulses in order to do calculations. It was capable of performing 25 calculations in a matter of minutes.

Mark I

Howard Aiken planned to build a machine in 1937 that could conduct massive calculations or calculations using enormous numbers. The Mark I computer was constructed in 1944 as a collaboration between IBM and Harvard.

Generations of Computers

A generation of computers refers to the specific improvements in computer technology with time. In 1946, electronic pathways called circuits were developed to perform the counting. It replaced the gears and other mechanical parts used for counting in previous computing machines.

In each new generation, the circuits became smaller and more advanced than the previous generation circuits. The miniaturization helped increase the speed, memory and power of computers. There are five generations of computers which are described below:-

First Generation Computers

The first generation (1946-1959) computers were slow, huge and expensive. In these computers, vacuum tubes were used as the basic components of CPU and memory. These computers were mainly depended on batch operating system and punch cards. Magnetic tape and paper tape were used as output and input devices in this generation;

Second Generation Computers

The second generation (1959-1965) was the era of the transistor computers. These computers used transistors which were cheap, compact and consuming less power; it made transistor computers faster than the first generation computers.

In this generation, magnetic cores were used as the primary memory and magnetic disc and tapes were used as the secondary storage. Assembly language and programming languages like COBOL and FORTRAN, and Batch processing and multiprogramming operating systems were used in these
computers.

Third Generation Computers
The third generation computers used integrated circuits (ICs) instead of transistors. A single IC can pack huge number of transistors which increased the power of a computer and reduced the cost. The computers also became more reliable, efficient and smaller in size. These generation computers used remote processing, time-sharing, multi programming as operating system. Also, the high-level programming languages like FORTRON-II TO IV, COBOL, PASCAL PL/1, ALGOL-68 were used in this generation.

Fourth Generation Computers
The fourth generation (1971-1980) computers used very large scale integrated (VLSI) circuits; a chip containing millions of transistors and other circuit elements. These chips made this generation computers more compact, powerful, fast and affordable. These generation computers used real time, time sharing and distributed operating system. The programming languages like C, C++, DBASE were also used in this generation.

Fifth Generation Computers
In fifth generation (1980-till date) computers, the VLSI technology was replaced with ULSI (Ultra Large Scale Integration). It made possible the production of microprocessor chips with ten million electronic components. This generation computers used parallel processing hardware and AI (Artificial Intelligence) software. The programming languages used in this generation were C, C++, Java, .Net, etc.

Q-3: How many types of Computer? Explain About Analogue, digital and Hybrid computers.

We can categorize computer in two ways:
- On the basis of data handling capabilities
- On the basis of size & Processing Speed.

On the basis of data handling capabilities, the computer is of three types:
1. Analogue Computer
2. Digital Computer
3. Hybrid Computer

1) Analogue Computer
Analogue computers are designed to process analogue data. Analogue data is continuous data that changes continuously and cannot have discrete values. We can say that analogue computers are used where we don't need exact values always such as speed, temperature, pressure and current.
Analogue computers directly accept the data from the measuring device without first converting it into numbers and codes. They measure the continuous changes in physical quantity and generally render output as a reading on a dial or scale. Speedometer and mercury thermometer are examples of analogue computers.

2) Digital Computer
Digital computer is designed to perform calculations and logical operations at high speed. It accepts the raw data as input in the form of digits or binary numbers (0 and 1) and processes it with programs stored in its memory to produce the output. All modern computers like laptops, desktops including smartphones that we use at home or office are digital computers.

3) Hybrid Computer
Hybrid computer has features of both analogue and digital computer. It is fast like an analogue computer and has memory and accuracy like digital computers. It can process both continuous and discrete data. It accepts analogue signals and converts them into digital form before processing. So, it is widely used in specialized applications where both analogue and digital data is processed. For
example, a processor is used in petrol pumps that converts the measurements of fuel flow into quantity and price. Similarly, they are used in airplanes, hospitals, and scientific applications.

On the basis of size, the computer can be of five types:
1) Supercomputer

Supercomputers are the biggest and fastest computers. They are designed to process huge amount of data. A supercomputer can process trillions of instructions in a second. It has thousands of interconnected processors.
Supercomputers are particularly used in scientific and engineering applications such as weather forecasting, scientific simulations and nuclear energy research. The first supercomputer was developed by Roger Cray in 1976.

2) Mainframe computer

Mainframe computers are designed to support hundreds or thousands of users simultaneously. They can support multiple programs at the same time. It means they can execute different processes simultaneously. These features of mainframe computers make them ideal for big organizations like banking and telecom sectors, which need to manage and process high volume of data.
Mainframe computers are designed to support hundreds or thousands of users simultaneously. They can support multiple programs at the same time. It means they can execute different processes simultaneously. These features of mainframe computers make them ideal for big organizations like banking and telecom sectors, which need to manage and process a high volume of data that requires integer operations such as indexing, comparisons, etc.

3) Miniframe or Minicomputer

It is a midsize multiprocessing computer. It consists of two or more processors and can support 4 to 200 users at one time. Mini frame computers are used in institutes and departments for tasks such as billing, accounting and inventory management. A minicomputer lies between the mainframe and microcomputer as it is smaller than mainframe but larger than a microcomputer.

4) Microcomputer

Microcomputer is also known as a personal computer. It is a general-purpose computer that is designed for individual use. It has a microprocessor as a central processing unit, memory, storage area, input unit and output unit. Laptops and desktop computers are examples of microcomputers. They are suitable for personal work that may be making an assignment, watching a movie, or at office for office work.

Q-4: What is the the basic components of computer? Explain.

A computer device is made up of various elements which help in its effective functioning and processing. There are 3 basic components of the computer which help in making this processing of data easier and convenient.

There are basically three important components of a computer:
- **Input Unit**
- **Central Processing Unit(CPU)**
- **Output Unit**

1. Input Unit:

The input unit consists of input devices that are attached to the computer. These devices take input and convert it into binary language that the computer understands.
- Some of the common input devices are keyboard, mouse, joystick, scanner etc.
- The Input Unit is formed by attaching one or more input devices to a computer.
- A user input data and instructions through input devices such as a keyboard, mouse, etc.
- The input unit is used to provide data to the processor for further processing.

2. Central Processing Unit:

Once the information is entered into the computer by the input device, the processor processes it. The CPU is called the brain of the computer because it is the control center of the computer. It first fetches instructions from memory and then interprets them so as to know what is to be done. If required, data is fetched from memory or input device. Thereafter CPU executes or performs the required computation, and then either stores the output or displays it on the output device.

The CPU has three main components, which are responsible for different functions:
Arithmetic Logic Unit (ALU),
Control Unit (CU) and
Memory Unit

A. Arithmetic and Logic Unit (ALU):

The ALU, as its name suggests performs mathematical calculations and takes logical decisions.
Arithmetic calculations include addition, subtraction, multiplication and division. Logical decisions involve the comparison of two data items to see which one is larger or smaller or equal.
- Arithmetic Logical Unit is the main component of the CPU
- It is the fundamental building block of the CPU.
- Arithmetic and Logical Unit is a digital circuit that is used to perform arithmetic and logical operations.

B. Control Unit:

The Control unit coordinates and controls the data flow in and out of the CPU, and also controls all the operations of ALU, memory registers and also input/output units. It is also responsible for carrying out all the instructions stored in the program. It decodes the fetched instruction, interprets it and sends control signals to input/output devices until the required operation is done properly by ALU and memory.

- The Control Unit is a component of the central processing unit of a computer that directs the operation of the processor.
- It instructs the computer's memory, arithmetic and logic unit, and input and output devices on how to respond to the processor's instructions.
- In order to execute the instructions, the components of a computer receive signals from the control unit.
- It is also called the central nervous system or brain of the computer.

C. Memory Unit:

When we enter the data into the computer using an input device, the entered information immediately gets saved in the memory unit of the Central Processing Unit (CPU). Because of the presence of some existing programming, the Memory Unit transmits the data further to the other parts of the CPU.
Similarly, when the output of our command is processed by the computer, it is saved in the memory unit before giving the output to the user.

3. Output Unit:

The output unit consists of output devices that are attached to the computer. It converts the binary data coming from the CPU to
human understandable form. The common output devices are monitor, printer, plotter, etc.

- The output unit displays or prints the processed data in a user-friendly format.
- The output unit is formed by attaching the output devices of a computer.
- The output unit accepts the information from the CPU and displays it in a user-readable form.

Q-5: What is computer computer memory? Explain about the different types of Memory.

Computer memory is any physical device, used to store data, information or instruction temporarily or permanently. It is the collection of storage
units that stores binary information in the form of bits. The memory block is split into a small number of components, called cells. Each cell has a
unique address to store the data in memory, ranging from zero to memory size minus one. For example, if the size of computer memory is 64k
words, the memory units have 64 * 1024 = 65536 locations or cells. The address of the memory's cells varies from 0 to 65535.

Classification of Memory
The two basic forms of memory in a computer are primary (volatile) and secondary (non-volatile)

1. Primary Memory

The main form of memory that the CPU directly accesses for immediate use during active processing is known as primary memory. Because data is
only stored there while the computer is powered on, it is known as volatile memory. The information kept in primary memory is lost when the
computer shuts down or loses power.

The two main categories of primary memory are

- **RAM (Random Access Memory)**
- **ROM (Read-Only Memory)**

1. RAM (Random Access Memory)

Random Access Memory (RAM) is a crucial type of primary memory in a computer system. It is volatile memory; the computer's processor (CPU) may
quickly access the information it contains to utilize it when processing is active. In contrast to secondary memory (such as hard drives or solid-state
drives), RAM doesn't save data when the computer is shut down.

Types of RAM are:

a. Dynamic Random Access Memory (DRAM)

The most popular type of RAM in contemporary systems is DRAM. It differs from other RAM types in simplicity, high density, and affordability. DRAM
uses capacitors as its data storage medium, necessitating frequent refreshing to ensure data integrity. It becomes dynamic due to this operation,
called “DRAM.” DDR SDRAM (Double Data Rate Synchronous DRAM), the most popular type of DRAM used in computers, comes in several versions,
including DDR2, DDR3, DDR4, and DDR5, each of which offers faster data transfer rates and higher efficiency.

b. Static Random Access Memory (SRAM)

SRAM is less dense and expensive than DRAM but is speedier and more energy-efficient. SRAM uses flip-flops to store data instead of DRAM, which
makes it static and eliminates the need for ongoing refreshing. Despite limiting SRAM’s capacity, this characteristic speeds up access times. People
frequently use SRAM in crucial locations such as CPU cache memory, where they need fast data access because of its high speed.

2. ROM (Read-Only Memory)

Read-Only Memory(ROM) is a form of computer memory that stores data permanently, retaining its contents even when the machine is powered
off. Data in ROM is “read-only” since, as the name implies, it cannot be easily changed or replaced. It provides vital firmware, data, and instructions
for the computer’s fundamental processes, including booting and system initialization.

Types of ROM are:

Programmable ROM (PROM)

After manufacturing the chip, one can program data onto it using a programmable ROM. It takes a specific tool called a “PROM programmer” to put
data into PROM. Once you program the information, you cannot alter it. You cannot change or delete data once you commence the procedure
because it is irreversible.

Erasable Programmable ROM (EPROM)

A form of ROM called an EPROM can be erased and reprogrammed by exposing it to ultraviolet (UV) radiation. UV radiation exposes the data,
causing the quartz window to allow UV light to pass through and wipe it clean. After erasure, a PROM programmer can program new information
onto the EPROM.

Electrically Erasable Programmable ROM (EEPROM)

EEPROM, commonly called E2PROM, is comparable to EPROM but allows for electrical erasure and reprogramming without UV light. Data updates
are more accessible and more flexible. People usually employ this when data may need to be changed regularly, including when updating BIOS or
recording user preferences in electronic devices.

2. Secondary Memory

A sort of computer memory used for long-term data storage, even while the computer is off, is secondary memory, often referred to as non-volatile
memory. Secondary memory preserves data longer than primary memory (RAM), which is volatile and temporary. It functions as a storage
repository for different files, programs, and other data types that the CPU doesn’t need to access or process immediately.

1. Hard Disk Drives (HDD)

Hard disc drives (HDD) are conventional mechanical data storage components in computers. The read/write heads access and store data on

magnetic discs, also known as platters, which rotate at high speeds. Magnetic patterns store data on the platters. HDDs are affordable and offer
large storage capabilities compared to other storage technologies. However, their performance sometimes suffers because the read/write process is
mechanical. HDDs are still often used for bulk data storage, backup, and archive needs even though Solid-State Drives (SSD) are faster.

2. Solid-State Drives (SSD)

Solid-State Drives (SSD) are modern storage devices that employ NAND flash memory to store data. SSDs have advantages over Hard Disc Drives
(HDD) because they are faster, more reliable, and more energy-efficient due to their fewer moving parts. Data storage eliminates the need for any
mechanical parts by using memory chips. This results in significantly faster data access. SSDs provide much quicker read and write speeds, enhancing
system performance overall and accelerating application loading times. They are commonly used as the primary storage drives in laptops and PCs,
offering rapid boot times and improved responsiveness. SSDs have grown in popularity because of their greater performance and dependability,
although they are often more expensive per gigabyte than HDDs.

3. Magnetic Tapes

Magnetic Tapes are a cost-effective and durable option for data backup and archival. They use magnetic patterns to store binary information on a
long strip wound onto a reel. Government agencies, research institutions, and large corporations frequently utilize them to store data for extended periods. Although they have slower access time than modern storage devices, they offer high storage capacity.

Unit-II

Q-1: What is the processor? Give its Introduction and define its types.

What is Processor in Computer?
A Processor is a key component in the computer system that is responsible for carrying out of all the program instructions and other principal functions of the computer. Also known as the CPU (Central Processing Unit), the processor executes every program instruction in a sequential manner in order to carry out the fundamental I/O, logical, and arithmetical operations for the system.

Components of a Processor
A processor has four components:

1. Arithmetic Logic Unit (ALU)
ALU is the main component in a processor that performs various arithmetic and logic operations. It is an integrated circuit within the CPU/GPU, due to which it is also known as an integer unit (IU). This is the last component that performs calculations in the processor.

2. Floating-Point Unit (FPU)
It is part of the computer system used for carrying out operations on floating-point numbers. These operations include square root, multiplication, division, subtraction, and addition. It can perform transcendental functions such as trigonometric and exponential functions; however, it may not be accurate.

3. Registers
Registers are types of computer memory that accept, transfer, and store data and instructions being used. It instructs ALU about the processes that must be carried out and stores the results of these operations.

4. Cache
Cache is the smaller yet faster memory located close to the processor's core. This memory stores the copy of data from the frequently used main locations. There are three levels of cache: L1, L2 and L3 cache. L1 is the primary chip, which is embedded in the processor chip. Since it is small, it has limited storage. L2 cache is the secondary cache that is either embedded on a processor chip or a separate

chip with a high-speed bus that connects it to the CPU. Also known as processor cache, L3 is a specialized backup memory for L1 and L2. It boosts the performance of L1 and L2.

Types of Processors

1. CISC (Complex Instruction Set Computer)

As the name suggests, the instructions are in a complex form. It means that a single instruction can contain many low-level instructions. For example loading data from memory, storing data to the memory, performing basic operations, etc. Besides, we can say that a single instruction has multiple addressing modes. Furthermore, as there are many operations in single instruction they use very few registers.

Examples of CISC are Intel 386, Intel 486, Pentium, Pentium Pro, Pentium II, etc.

Advantages of CISC are as follows:

- Microprogramming in CISC is as easy as the assembly language implementation.
- The number of instructions for performing operations is less in number. Hence, the memory usage is low. Moreover, time consumption is also less.

2. RISC (Reduced Instruction Set Computer)

As per the name, in this, the instructions are quite simple, and hence, they execute quickly. Moreover, the instructions get complete in one clock cycle and also use a few addressing modes only. Besides, it makes use of multiple registers so that interaction with memory is less.

Examples are IBM RS6000, DEC Alpha 21064, DEC Alpha 21164, etc.

Advantages of RISC are as follows:

- Instructions are simple hence easy to understand and decode.
- The instructions complete in one clock cycle therefore, CPU can handle multiple instructions at a time.
- Designing the RISC processors is easier in comparison to the CISC processors.

3. EPIC (Explicitly Parallel Instruction Computing)

It allows the instructions to compute parallelly by making use of compilers. Moreover, the complex instructions also process in fewer clock frequencies. Furthermore, it encodes the instructions in 128-bit bundles. Where each bundle contains three instructions encoded in 41 bits each and a 5-bit template. This 5-bit template contains information about the type of instructions and that which instructions can be executed in parallel.

Examples are IA-64 (Intel Architecture-64), etc.

Q-2: What do you understand by the term Processor specifications?

- Core Count
- Hyper-Threading support
- Base Clock Speed
- L Cache Size (L1, L2, L3)
- Memory Support
- Generation and Micro-architecture
- Integrated Graphics

1. Core Count

Most modern CPU'ss have multiple cores anywhere from 4,6,8 to upto 32 and 64. Each core is like a cpu within a cpu that can execute programs. Having multiple cores allows the cpu to run multiple programs simultaneously thereby making it faster. The more cores a processor has, the faster it can handle multiple processes, which is important for multitasking or for heavy workloads that can take advantage of multiple cores.

2. Hyper-threading support

Hyper-Threading feature when present on a cpu allows each core on the cpu to act somewhat as 2 cores. In other words, a 4 core cpu with hyperthreading support will appear to have 4 x 2 = 8 cores. Now this does not exactly double the performance but it does add some advantage. So a 4 core cpu with hyperthreading will be faster than a 4 core cpu without hyperthreading..

3. Clock Speed

A processor is driven by a digital clock that runs at a certain frequency measured in Hz. A cpu can perform some task with every clock cycle, so higher the clock speed the more instruction the cpu can execute. For example, a 3.1 GHz base clock processor can potentially perform 3.1 tasks each second. By task we mean program instructions.The higher the clock speed, the more tasks the processor can complete, and the faster your computer will generally run.

4. L Caches (L1, L2, L3)

Most modern CPUs have 3 Levels ('L') of caches to store data needed while executing program instructions. These are named L1, L2, and L3, with the capacity increasing with each level. If the data the processor needs can't be found in the L1 cache, it 'seeks' this data from the L2 cache and then the L3 cache. In terms of size the L1 cache is the smallest and L3 is the largest.
Whereas in terms of speed the L1 cache is the fastest and L3 is the slowest. Because these caches are built into the processor itself, they are the fastest memory a processor can access data from, starting with the L1 cache.

5. Memory Support
Any cpu supports only specific types of ram modules upto a certain size and speed. Modern systems are equipped with either DDR4 or DDR5 ram modules with DDR5 being the newer technology standard that supports higher bandwidth at lower speed. Most cpus will support DDR4 memory whereas only few latest cpus support DDR5 as of 2022. Also each cpu can support only upto a certain amount of maximum ram, like 128GB or 64GB.

6. Generation and Micro-Architecture
Each cpu belongs to a certain "technology generation" with each newer generation being more powerful and efficient than the previous. Each next generation features more efficient architecture, smaller and higher number of transistors, more power efficient design, support for newer technologies etc.
A modern-day CPU is made up of billions of transistors. The manufacturing process which is measured in nm (nanometers) refers to the semiconductor fabrication technology used to manufacture a CPU.

7. Integrated Graphics
Many CPUs come with integrated graphics on the chip itself, meaning you don't need a dedicated GPU to drive your monitor. While an integrated graphics solution is a solid option for casual users, other users add a discrete graphics card to their system for more powerful graphics performance.
Integrated graphics can also be helpful when troubleshooting a discrete graphics card as you can still display an image on your monitor even if your discrete GPU is malfunctioning.

Q-3: What is a Motherboard? Give its introduction and also define components of motherboard.

A computer's motherboard is typically the largest printed circuit board (PCB) in a machine's chassis. It distributes electricity and facilitates communication between and to the central processing unit (CPU), random access memory (RAM), and any other component of the computer's hardware.

Computer Motherboard Components and the Functions

1. Mouse & keyboard connectors: Keyboard Connectors are two types basically. All PCs have a Key board port connected directly to the motherboard. The oldest, but still quite common type, is a special DIN, and most PCs until recently retained this style connector. The AT-style keyboard connector is quickly disappearing, being replaced by the smaller mini DIN PS/2-style keyboard connector.
You can use an AT-style keyboard with a PS/2-style socket (or the other way around) by using a converter. Although the AT connector is unique in PCs, the PS/2-style mini-DIN is also used in more modern PCs for the mouse. Fortunately, most PCs that use the mini-DIN for both the keyboard and mouse clearly mark each mini-DIN socket as to its correct use. Some keyboards have a USB connection, but these are fairly rare compared to the PS/2 connection keyboards.

2. USB (Universal serial bus): USB is the General-purpose connection for PC. You can find USB versions of many different devices, such as mice, keyboards, scanners, cameras, and even printers. A USB connector's distinctive rectangular shape makes it easily recognizable. USB has a number of features that makes it particularly popular on PCs. First, USB devices are hot swappable. You can insert or remove them without restarting your system.

3. Parallel port: Most printers use a special connector called a parallel port. Parallel port carries data on more than one wire, as opposed to the serial port, which uses only one wire. Parallel ports use a 25-pin female DB connector. Parallel ports are directly supported by the motherboard through a direct connection or through a dangle.

4. CPU Chip: The central processing unit, also called the microprocessor performs all the calculations that take place inside a pc. CPUs come in Variety of shapes and sizes. Modern CPUs generate a lot of heat and thus require a cooling fan or heat sink. The cooling device (such as a cooling fan) is removable, although some CPU manufactures sell the CPU with a fan permanently attached.

5. RAM slots: Random-Access Memory (RAM) stores programs and data currently being used by the CPU. RAM is measured in units called bytes. RAM has been packaged in many different ways. The most current package is called a 168-pin DIMM (Dual Inline Memory module).

6. Floppy controller: The floppy drive connects to the computer via a 34-pin ribbon cable, which in turn connects to the motherboard. A floppy controller is one that is used to control the floppy drive.

7. IDE controller: Industry standards define two common types of hard drives: EIDE and SCSI. Majority of the PCs use EIDE drives. SCSI drives show up in high end PCs such as network servers or graphical workstations. The EIDE drive connects to the hard drive via a 2-inch-wide, 40-pin ribbon cable, which in turn connects to the motherboard. IDE controller is responsible for controlling the hard drive.

8. PCI slot: Intel introduced the Peripheral component interconnect bus protocol. The PCI bus is used to connect I/O devices (such as NIC or RAID controllers) to the main logic of the computer. PCI bus has replaced the ISA bus.

9. ISA slot: (Industry Standard Architecture) It is the standard architecture of the Expansion bus. Motherboard may contain some slots to connect ISA compatible cards.

10. CMOS Battery: To provide CMOS with the power when the computer is turned off all motherboards comes with a battery. These batteries mount on the motherboard in one of three ways: the obsolete external battery, the most common onboard battery, and built-in battery.

11. AGP slot: If you have a modern motherboard, you will almost certainly notice a single connector that looks like a PCI slot, but is slightly shorter and usually brown. You also probably have a video card inserted into this slot. This is an Advanced Graphics Port (AGP) slot.

12. CPU slot: To install the CPU, just slide it straight down into the slot. Special notches in the slot make it impossible to install them incorrectly. So remember if it does not go easily, it is probably not correct. Be sure to plug in the CPU fan's power.

13. Power supply plug in: The Power supply, as its name implies, provides the necessary electrical power to make the pc operate. The power supply takes standard 110-V AC power and converts into 12-Volt, 5-Volt, and 3.3-Volt DC power.

Q4: Explain various types of motherboard. Also discuss about BIOS and CMOS.

With consistent components and functionalities, motherboards are found in various devices such as desktops, laptops, tablets, and smart phones. However, their size and component accommodation vary based on available space. In desktops, most components are socketed for easy individual replacement. In contrast, laptops and smart phones have soldered components, making upgrades challenging. Manufacturers have developed different factors for motherboards to suit computer designs, categorizing them based on capabilities, features, and physical size/shape. Motherboards are described using form factor called Advanced Technology eXTENDED (ATX) and this form factor is invented by INTEL
company and it has been industry standard for years now. ATX not only describes motherboard layout but also lays specification for power supply and PC cabinets and different connectors for compatibility purposes.

Different types of motherboard are as follows:

1. AT Motherboard
AT motherboards have larger physical dimensions, measuring in the hundreds of millimeters, which makes them incompatible with the mini desktop category of computers. Furthermore, the increased size hinders the installation of new drivers. Power connectors in these motherboards utilize sockets and six-pin plugs. Unfortunately, these power connectors are not easily recognizable, leading to difficulties for users when connecting and using them. This type of motherboard was in vogue in the 1980s, and it enjoyed a substantial self-life.

2. ATX Motherboard
Intel developed Advanced Technology Extended (ATX) during the 1990s, an improvement over an earlier version of the AT motherboard. It is smaller than the AT motherboard and offers the interchangeability of connected components. The connector aspects have been significantly improved in ATX.

3. LPX Motherboard
These types of motherboards have made two improvements over the earlier versions. Firstly, it relocated Input and Output ports to the back side, providing a more convenient arrangement. Secondly, it introduced a Riser Card to enable more slots and facilitate easier connections. Some of these features were implemented in the AT motherboard.
However, a major disadvantage of this board was the lack of Accelerated Graphic Port (AGP) slots, resulting in a direct connection to PCI. The issues associated with these motherboards were addressed in the NLX boards.

4. BTX Motherboard

BTX denotes Balanced Technology Extended, intended to manage the demands of new technologies in terms of more power requirements, hence generating more heat. Intel stopped the further development of BTX boards during the mid- 2000s to concentrate on low-power CPUs.

5. Pico BTX Motherboard
These boards, aptly named "Pico" due to their compact size, offer a smaller form factor. Despite sharing the top half of BTX, they support two expansion slots. A unique feature of these boards is their compatibility with half-height or riser cards, which effectively meet the demands of digital applications.

6. Mini ITX Motherboard
It's a miniature version of the motherboard over its earlier versions. It was 17 x 17 cm in the early 2000s. Mainly used in small form factor (SFF) computers due to its lower power consumption and faster cooling ability. This motherboard is the most preferred in the home theater domain due to its lower fan noise level, which will improve the quality of the theatre system.

Q. What is BIOS?

A basic input/output system or BIOS is a program fixed and embedded on a device's microprocessor that helps to initialize hardware operations and manage the data flow to and from the operating system (OS) at the time of boot up. Gary Kildall, a U.S. computer scientist, invented the word BIOS in 1975. It was integrated into IBM's original PC in 1981, and gained popularity with additional PCs over the years, eventually becoming a fundamental characteristic of computers. However, a newer technology – Unified Extensible Firmware Interface (UEFI), has eclipsed BIOS in terms of adoption. Intel declared in 2017 its intention to discontinue support for the outdated BIOS platforms by 2020 and replace them with UEFI.

OR

BIOS, in full Basic Input/output System, computer program that is typically stored in EPROM and used by the CPU to perform start-up procedures when the computer is turned on. Its two major procedures are determining what peripheral devices (keyboard, mouse, disk drives, printers, video cards, etc.) are available and loading the operating system (OS) into main memory. After start-up, the BIOS program manages data flow between the OS and the peripherals, so neither the OS nor the application programs need to know the details of the peripherals (such as hardware addresses). In the early 21st century, BIOS was supplanted by United Extensible Firmware Interface (UEFI), which can handle much larger drives and operate faster than BIOS.

The BIOS's functionality may be divided into four tasks:

- Installation of complementary metal-oxide semiconductors (CMOS): This setup application allows users to modify hardware and system settings. CMOS refers to the nonvolatile memory of the BIOS.
- Bootstrap loader: This function of the bootstrap loader locates the OS.
- Software/drivers: This function identifies the device drivers and software that interact with the operating system once it is running.
- Power-on self-test (POST): It checks the computer's hardware before loading the operating system.

What is CMOS?
Complementary metal-oxide-semiconductor (CMOS) is a small amount of memory on a computer motherboard that stores the Basic Input/Output System (BIOS) settings. The BIOS is the software stored on the memory chip on the motherboard. It instructs the computer on how to perform a number of basic functions such as booting and keyboard control. The BIOS is also used to identify and configure hardware in the computer. For no boot or no display issues, clearing CMOS may help recover the boards because that restores the BIOS default settings.

OR

Alternatively known as an RTC (real-time clock), NVRAM (non-volatile random-access memory), or CMOS RAM, CMOS is short for complementary metal-oxide semiconductor. CMOS is an onboard, battery-powered semiconductor chip inside computers that stores information. This information ranges from the system time and date to your computer's hardware settings. The picture shows an example of the most common CMOS coin cell battery (Panasonic CR 2032 3V) used to power the CMOS memory.

Q-4: Write a short Note on following
- **ROM**
- **RAM**
- **SRAM**
- **DRAM**

Q. What is ROM?
ROM stands for Read Only Memory. The memory from which we can only read but cannot write on it. This type of memory is non-volatile. The information is stored permanently in such memories during manufacture. A ROM stores such instructions that are required to start a computer. This operation is referred to as bootstrap. ROM chips are not only used in the computer but also in other electronic items like washing machine and microwave oven.

The various types of ROMs

PROM (Programmable Read Only Memory)
PROM is read-only memory that can be modified only once by a user. The user buys a blank PROM and enters the desired contents using a PROM program. Inside the PROM chip, there are small fuses which are burnt open during programming. It can be programmed only once and is not erasable.

EPROM (Erasable and Programmable Read Only Memory)
EPROM can be erased by exposing it to ultra-violet light for a duration of up to 40 minutes. Usually, an EPROM eraser achieves this function. During programming, an electrical charge is trapped in an insulated gate region. The charge is
retained for more than 10 years because the charge has no leakage path. For erasing this charge, ultra-violet light is passed through a quartz crystal window (lid). This exposure to ultra-violet light dissipates the charge. During normal use, the quartz lid is sealed with a sticker.

EEPROM (Electrically Erasable and Programmable Read Only Memory)
EEPROM is programmed and erased electrically. It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 ms (millisecond). In EEPROM, any location can be selectively erased and programmed. EEPROMs can be erased one byte at a time, rather than erasing the entire chip. Hence, the process of reprogramming is flexible but slow.

What is RAM?
RAM stands for Random Access Memory, is a hardware device generally located on the motherboard of a computer and acts as an internal memory of the CPU. It allows CPU store data, program, and program results when you switch on the computer. It is the read and write memory of a computer, which means the information can be written to it as well as read from it. RAM is a volatile memory, which means it does not store data or instructions permanently.

The various types of RAM's:

1) Static RAM:
Static RAM (SRAM) is a type of random access memory that retains its state for data bits or holds data as long as it receives the power. It is made up of memory cells and is called a static RAM as it does not need to be refreshed on a regular basis because it does not need the power to prevent leakage, unlike dynamic RAM. So, it is faster than DRAM.
2) Dynamic RAM:
Dynamic Ram (DRAM) is also made up of memory cells. It is an integrated circuit (IC) made of millions of transistors and capacitors which are extremely small in size and each transistor is lined up with a capacitor to create a very compact memory cell so that millions of them can fit on a single memory chip. So, a memory cell of a DRAM has one transistor and one capacitor and each cell represents or stores a single bit of data in its capacitor within an integrated circuit.

Q. 5: What is BUS? Explain various types of Computer Buses. Also explain about add-on cards.

A bus is a subsystem that is used to connect computer components and transfer data between them. For example, an internal bus connects computer internals to the motherboard.

OR

The electrically conducting path along which data is transmitted inside any digital electronic device. A Computer bus consists of a set of parallel conductors, which may be conventional wires, copper tracks on a PRINTED CIRCUIT BOARD, or microscopic aluminum trails on the surface of a silicon chip. Each wire carries just one bit, so the number of wires determines the largest data WORD the bus can transmit: a bus with eight wires can carry only 8-bit data words, and hence defines the device as an 8-bit device.
A computer bus normally has a single word memory circuit called a LATCH attached to either end, which briefly stores the word being transmitted and ensures that each bit has settled to its intended state before its value is transmitted. The Computer bus helps the various parts of the PC communicate. If there was no bus, you would have an unwieldy number of wires connecting every part to every other part. It would be like having separate wiring for every light bulb and socket in your house.

Types of Computer Bus

There are a variety of buses found inside the computer.
- **Data Bus:** The data bus allows data to travel back and forth between the microprocessor (CPU) and memory (RAM).
- **Address Bus:** The address bus carries information about the location of data in memory.
- Control Bus: The control bus carries the control signals that make sure everything is flowing smoothly from place to place.
- **Expansion Bus:** If your computer has expansion slots, there's an expansion bus. Messages and information pass between your computer and the add-in boards you plug in over the expansion bus.
- **Internal bus:** An internal bus enables the communication between internal components, such as a video card and memory.

 External bus: An external bus can communicate with external peripherals, such as a USB or SCSI device.
 Parallel bus: A computer bus can transmit its data using either a parallel method of communication. With a parallel bus, data is transmitted several bits at a time.
 Serial bus: A computer bus can transmit its data using serial method of communication. With a serial bus, the data is transferred one bit at a time.

Q. What is an expansion card?
Add-in card (add-on card, expansion card) a printed circuit board that plugs into an expansion slot in a computer to provide some extra facility. The sockets normally connect to a bus, and the type of connector and the use to which each contact is put are strictly defined to ensure compatibility between the card and the computer. Cards are available that provide extra memory, communications interfaces, sound I/O capabilities, device interfaces to extra disks or tape backup devices, for instance, or perhaps extra processors in multiprocessor systems.
OR
An expansion card, also known as an expansion board or add-on card, is a hardware component that you can insert into a computer's expansion slot to enhance its functionality. These cards provide additional features and capabilities that the computer's basic configuration may not have initially included.

What are some common types of expansion cards?

There are various types of expansion cards available, depending on the purpose and functionality you require. Some common examples include graphics cards, sound cards, network interface cards (NICs), WiFi cards, universal serial bus (USB) expansion cards, and storage controller cards such as redundant array of independent disks (RAID) cards.

Why would I need an expansion card?
You may need an expansion card to add specific features or capabilities to your computer. For example, if you want to improve the graphics performance for gaming or graphic design, you can install a dedicated graphics card. If you need to connect your computer to a wired or wireless network, a network interface card or WiFi card will come in handy.
Expansion cards allow you to customize and upgrade your computer to suit your needs.

How do I install an expansion card?
To install an expansion card, you typically need to open your computer's case and locate an available expansion slot on the motherboard. Carefully insert the card into the appropriate slot, ensuring it is firmly seated. Secure the card in place using screws or latches provided. Finally, close the computer case and power on the system. The operating system should automatically detect the new hardware, but you may need to install drivers or configure settings for the card to function correctly.