COMPONENTS OF SYSTEM UNIT

COMP101 / COMP-111

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Chapter 2

Components of System Unit

Q.1: What is System Unit?

System unit is the main body of the computer. It is a case that contains different electronic components of the computer. These components include a central processing unit, memory (i.e. RAM, ROM), disk drives, power supply, computer fan, and other electronic components. All these components are connected to motherboard inside the system unit. All computers and mobile devices have a system unit. Input/output devices and some storage devices such as USB flash drive are connected with system unit. Different types of computers have system units of different shapes and sizes. In laptop computers, keyboard with a pointing device is built on the top of the system unit. Display screen is attached to system unit with hinges. Similarly, in mobile devices and many other mobile computers, display screen and keyboard are often built on system unit.
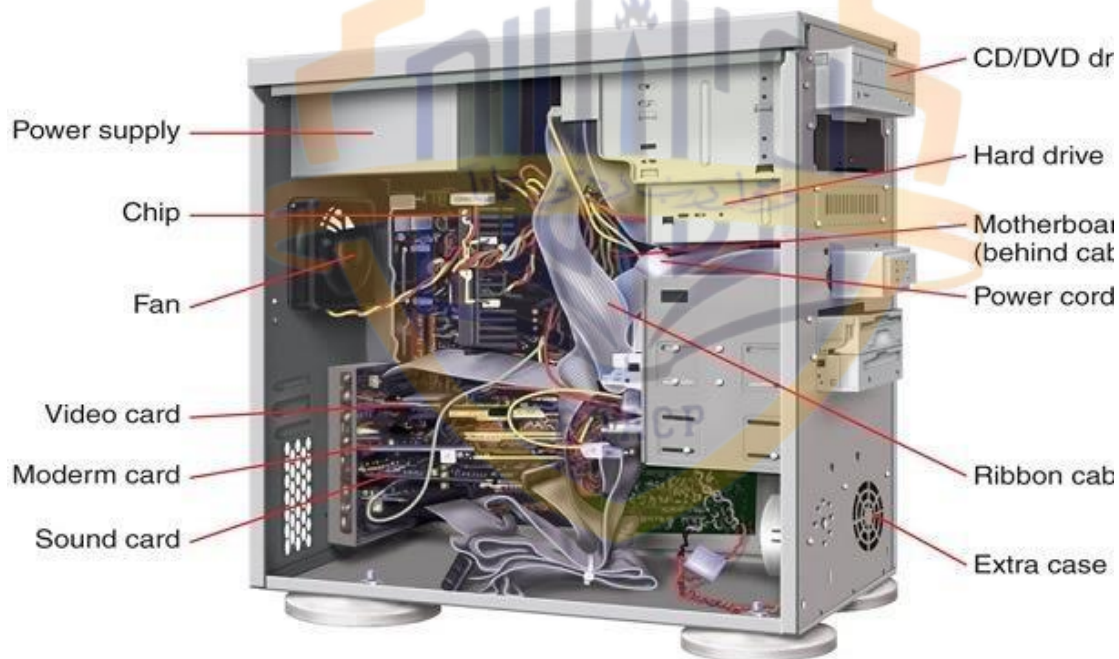

Components of System Units:

Motherboard:

Motherboard is the main circuit board of the system unit. It is also known as the system board or main board. It is the most important circuit board inside the system unit. Many electronic components are connected to motherboard and some components are built into it. Processor chip and memory chips are

plugged (installed) into motherboard. Motherboard contains sockets or slots on which electronic components are installed.
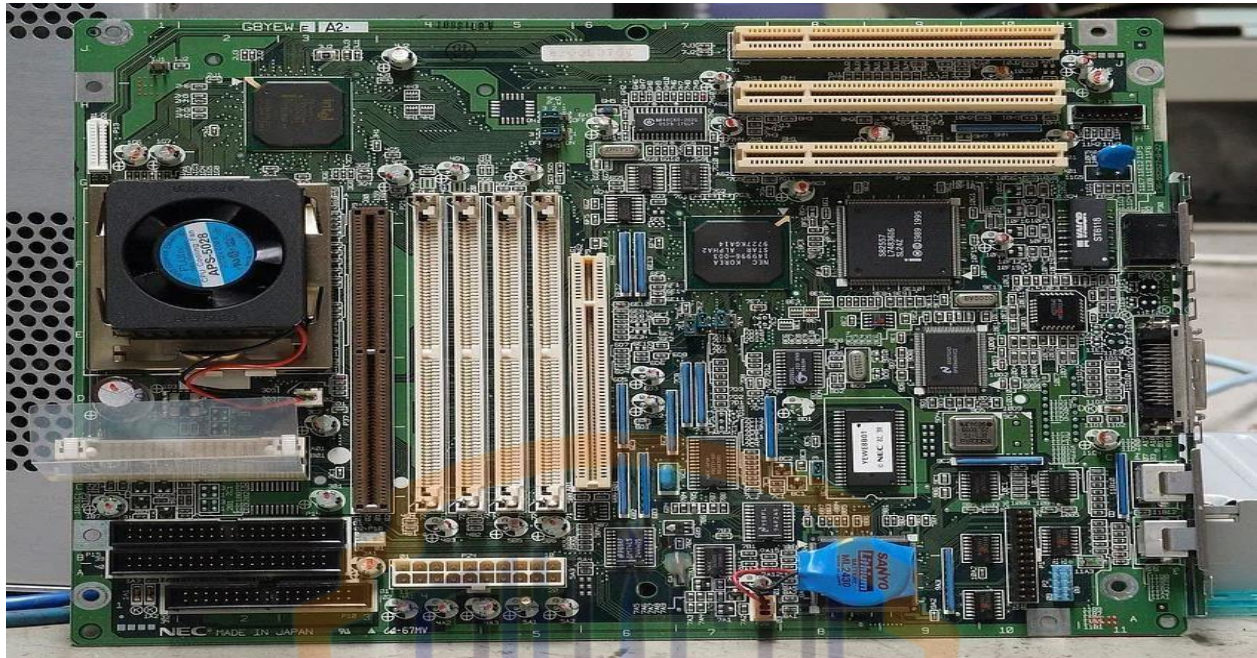
Central Processing Unit (CPU):

Simply called a CPU. It is the most important component of the computer. Also known as a processor. CPU is considered as the brain of the computer. It performs different operations on data according to given instructions. It also manages other operations of the computer. CPU used in a personal computer is known as a microprocessor. It is located on motherboard inside the system unit. It consists of a single chip. Today most of the processor chip manufacturers providing multi-core processors. A multi-core processor is a single chip that contains two or more processors. Each processor is called processor core or simply core. Operating system views each processor core as a separate processor. A multi-core processor typically increases overall performance of computer system

Components of CPU:

CPU contains two main components: Control Unit and the Arithmetic Logic Unit (ALU). These two components work together to perform different operations in computer system.

Control Unit (CU)

Control unit is the most important component of CPU. It controls and coordinates most of the operations in computer and its different components. For example, control unit receives data and instructions from input device and stores them in main memory. Similarly, it sends output to output device. Control unit also controls execution of instructions of program. It fetches instructions and data from memory unit. It decodes and executes instructions one by one. If there is an arithmetic or logical operation, control unit issues a command signal to Arithmetic Logic Unit (ALU) to perform required operation on data.

Arithmetic Logic Unit (ALU)

It performs arithmetic and logical operations on data. ALU performs arithmetic operations like addition, subtraction, multiplication, and division. ALU also performs logical operations by comparing numerical data as well as alphabetic data. For example, it checks whether first number is greater than second, less than second or equal to second, etc.

Registers:

A processor contains small, high-speed storage locations. These storage locations are called **registers.** Registers are used during program execution. They temporarily hold instructions, data, or intermediate results of calculations. The size of these registers is 2 or 4 or 8 bytes. The large sizes of registers increase the performance of CPU. For example, a computer having 32-bit (4-bytes) registers means CPU can process four bytes of data at a time. A processor has different types of registers. Each register is used for a specific purpose.

Machine Cycle

Process by which CPU obtains a program instruction from memory, decodes & executes it, and stores result in memory (if necessary). Also known as instruction cycle. CPU performs four basic operations to take action on each instruction of program. These operations are fetching, decoding, executing, and storing (if necessary).
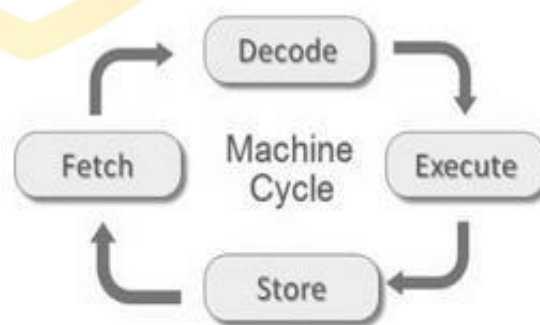
Fetching: Control unit obtains an instruction (or data item) from memory for taking action on it

Decoding: Control unit translates instruction into signals so that computer can understand it. Control unit analyzes the instruction to determine the type of action to be performed. Control unit also reads any required data from main memory to be processed.

Executing: Control unit takes action on decoded instruction. After decoding instruction and getting required data, control unit executes instruction.

Storing: Control unit may be required to store results of executed instruction in memory (but this condition is not always required)

Memory:

Temporary storage area for data, instructions, and information. It consists one or more chips on motherboard. It is calculated in By the number of bytes available like Kilobyte (KB), Megabyte (MB) or Gigabyte (GB) etc. There are two types of system unit memory.

- ▪ **Volatile memory**, which loses its contents when the computers power is turned off.
- ▪ **Nonvolatile memory**, which does not loses its content when the computers power is turned off. Memory in a computer refers to **RAM** (random access memory). It consists of memory chips that can be read and written to by the processor and other devices. It is also called main memory or primary storage. RAM is a volatile memory. Computer respond faster in case of high RAM capacity.

ROM (read-only memory) refers to memory chips that only can be read and used, which means they cannot be modified. ROM is nonvolatile memory (NVM), meaning that its contents are not lost when the computer's power is turned off. A variation of the ROM chip, called programmable read-only memory (PROM), is a blank chip on which you can place items permanently.

Expansion Slots and expansion cards:

An expansion slot is an opening, or socket, where you can insert a circuit board into the motherboard. These circuit boards are called; card, expansion board, expansion board, adapter card, adapter, interface card, add-in, and add-on. There are four types of expansion cards found in most of today's computers like Video card, Sound card, Network interface card and Modem card.

Ports:

A cable often attaches external devices to the system unit. A port is the point of attachment to the system unit. Ports have different types of connectors which are used to connect a cable with a device. Male connectors have one or more exposed pins. Female connectors have matching holes to accept the pins. Most computers have three **types** of ports; Serial port, Parallel port and Universal serial bus

Buses

Bits are transfer internally within the circuitry of the computer along electrical channels. These channels are called a bus. They allow the various devices inside and attached to the system unit to communicate with each other. The bus width determines the number of bits that can be transferred at one time. In most computer word size is the number of bits the processor can interpret and execute at a given time.

- A computer has two basic types of buses
    - System bus – connects the CPU to main memory.
    - Expansion bus – allows the CPU to communicate with peripheral devices.

Q. Write a note on Memory

A component of computer that is used to store data and instructions is called **memory.** Personal computer contains a main memory. Before processing data, control unit must load data and instructions in main memory. It reads data and instructions from main memory and processes data according to given instructions. Data and results of calculations are also stored in main memory. Main memory is also known as **working area of the computer.** A computer cannot work without having main memory.

Structure of Memory:

Main memory used in a modern computer is built in the form of a chip. Chip is made of semiconductor material. Main memory of a computer consists of thousands or millions of cells. Each cell can store a bit (Binary digit). A bit represents 0 or 1. These cells are logically organized into a group of 8 bits called a byte. A byte is the basic storage unit in memory. When instructions of program and data are transferred to memory from a storage device (i.e. hard disk), instructions and data exist in memory as bytes. Each byte exists temporarily in a specific memory location that has an address. The address is a unique number that identifies the location of a byte in memory.

Memory Access Time:

The amount of time required by a processor to read data or instruction from memory is called access time. Usually, access time is measured in nanoseconds (A nanosecond is one-billionth of a second). Some manufacturers state access time in megahertz (MHz). Access time affects overall performance of the computer. Control unit can access any byte of data from main memory by specifying its address.

Different bytes from main memory can be accessed directly (or randomly). Accessing any part of memory takes an equal amount of time. It is very fast as compared to other storage devices such as hard disk and an optical disk. For example, accessing data from main memory is more than 200,000 times faster than accessing data from the hard disk. It is because; main memory does not involve any mechanical movement in accessing data or instruction.

Memory size:

Storage capacity of memory is expressed in terms of number of bytes. The data and program sizes are also measured in bytes. Today, computer memories are available up to a terabyte. In near future, memories will be available up to Yottabytes (YB).

MEMORY UNIT	EQUIVALENT TO
1 Bit	1 Binary Digit (0 or 1)
1 Byte	8 Bits
1 Kilobyte (KB)	2^{10} Bytes = 1024 Bytes
1 Megabyte (MB)	2^{20} Bytes = 1024 KB
1 Gigabyte (GB)	2^{30} Bytes = 1024 MB
1 Terabyte (TB)	2^{40} Bytes = 1024 GB
1 Petabyte (PB)	2^{50} Bytes = 1024 TB
1 Exabyte (EB)	2^{60} Bytes = 1024 PB
1 Zettabyte (ZB)	2^{70} Bytes = 1024 EB
1 Yottabyte (YB)	2^{80} Bytes = 1024 ZB

Types of memory.

There are two types of memory:

- Volatile Memory
- Non-Volatile Memory

Volatile Memory:

A type of computer memory that requires continuous power (electricity) to maintain stored information. In this type of memory, data and instructions are stored temporarily. It loses its contents (stored information) when computer is turned off. So it is a temporary memory. Examples are RAM, cache memory, and CPU registers.

Non – Volatile Memory

A type of computer memory that can maintain (retain) stored information even when power supply is off (or interrupted). In this type of memory, data and instructions are stored permanently. It does not lose its contents when the computer is turned off. So it is a permanent memory. Examples ROM, flash memory, and all secondary storage devices.

Q. Write a note on RAM.

RAM stands for Random Access Memory. RAM is also known as primary memory. RAM is a **volatile memory (**It means that data and programs stored in RAM are lost when the power is turned off). It consists of memory chips on motherboard. It is used in a computer for storage of active programs and data. Processor can directly write and read information (data & instructions) to and from RAM. It is **Read / write memory** because processor can write and read information (data and instructions) to and from it. Data and instructions are stored in it temporarily. Processor loads data and instructions in RAM from a storage device such as a hard disk. Processor processes data according to program instructions by fetching data and instructions from RAM. Processor interprets and executes program instructions while program is in RAM. During this time, contents of RAM may change. RAM can hold multiple programs simultaneously, provided the computer has enough RAM to accommodate all programs. Information must be saved on storage devices for later use. The storage capacity of RAM is measured in bytes. In PCs, size of RAM is 4GB to 32 GB or more. More RAM size means computer can use a powerful program with a large size. It also improves performance of computer
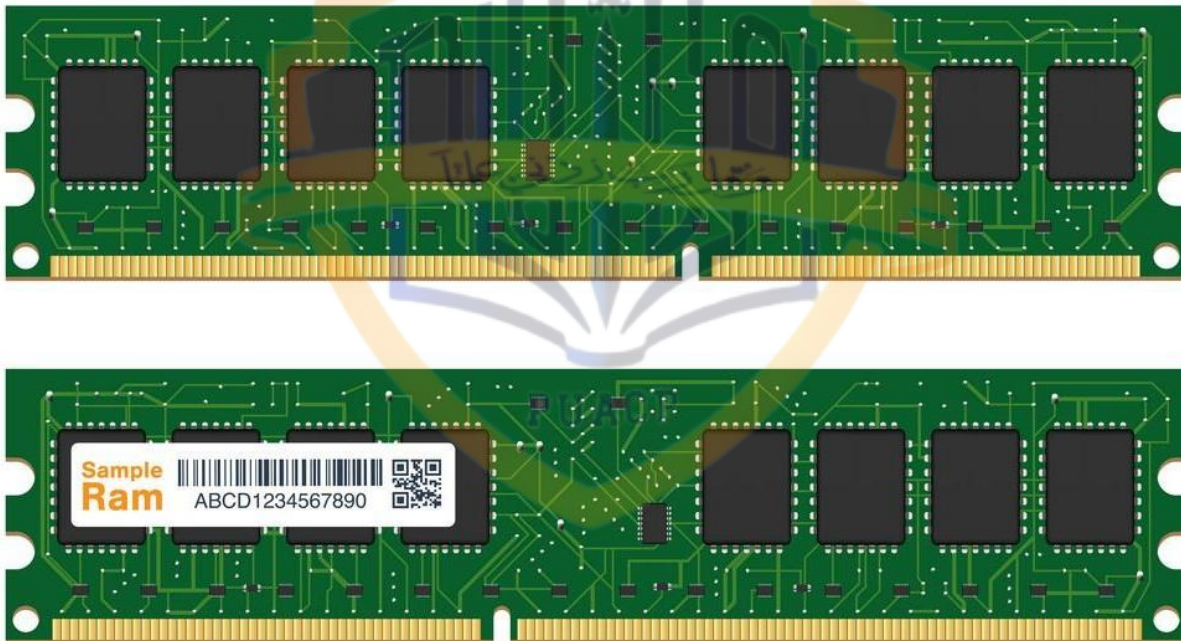
Types of RAM

There are two Types of RAM

- SRAM
- DRAM

Dynamic RAM (DRAM):

DRAM stands for Dynamic Random Access Memory. This type of RAM is used in most of the

computers. In order to maintain data in DRAM, it is refreshed with electric charge again and again; otherwise, data

stored into it can be lost. During refreshing process, CPU has to wait for writing and reading data to and from DRAM. Therefore, it is a slow memory.

Characteristics of Dynamic RAM

- Short data lifetime
- Needs to be refreshed continuously
- Slower as compared to SRAM
- Used as RAM
- Smaller in size
- Less expensive
- High power consumption

Static RAM (SRAM):

SRAM stands for Static Random Access Memory. It does not have to be refreshed with electric charge again and again. It is faster than DRAM because CPU does not have to wait to access data from SRAM. SRAM chips utilize less power than DRAM. SRAM chip is more expensive than DRAM chip. In most modern computer SRAM technology is used to build a very fast memory. This fast memory is known as **cache memory**

Characteristic of Static RAM

- Long life
- No need to refresh
- Faster
- Used as cache memory
- Large size
- Expensive
- Low power consumption

Q. Write a note on Random Access Memory (ROM).

ROM stands for Read Only Memory. It is a memory chip in which data and instructions can be stored permanently. ROM is a non-volatile memory. It means that its contents are not lost when the computer is turned off. Data and instructions stored on most of the ROM chips cannot be modified. Data and instructions stored in ROM can only be read. This is the reason why it is called read only memory.
However, in some types of ROM chips data and instructions can be erased and reprogrammed.

Manufacturers of ROM chips often record data and instructions on ROM chips when they manufacture chips (These ROM chips are called firmware). Mostly, ROM chip contains instructions that help booting process of a computer. When computer is switched on, instructions in ROM chip are automatically activated and prepare computer for use. Many other devices also contain ROM chips. For example, a printer has a ROM chip that contains data or information for fonts. Almost every electronic device has a ROM chip that contains information or software about that device and controls its different operations

Q. Write a note on Types of ROM.
There are three types of ROM.

- PROM
- EPROM
- EEPROM

PROM:
PROM stands for Programmable Read Only Memory. This type of ROM is initially blank. User or manufacturer can write data or programs on it by using special devices. However, once program or data is written on PROM chip, it cannot be changed. If there is an error in writing program or data on PROM chip, error cannot be removed. PROM chip becomes unusable.

EPROM:
EPROM stands for Erasable Programmable Read Only Memory. This form of ROM is also initially blank. User or manufacturer can write a program or data on it by using special devices. Program or data written on EPROM chip can be removed (erased) by using special devices and ultraviolet rays. So program or data written on EPROM chip can be changed and new data can also be added. EPROMs are generally used in devices in which information or

programs are repeatedly changed (updated).

EEPROM:

EEPROM stands for Electrically Erasable Programmable Read Only Memory. In this type of ROM, user can write or change instructions and information with the help of electrical devices. So data stored in this type of ROM chip can be modified easily.

Q. Differentiate between RAM & ROM.

ROM	RAM
It is Read only Memory.	It is Random Access Memory.
Permanent Memory	Temporary memory
Manufacturer of ROM can only write data and programs into it at its manufacturing time	User can read and write data and programs into it at any time during data processing
Small storage capacity	Large storage capacity
Data is written into it using special devices and ultraviolet rays	Data is written into it using electrical devices

Q. Write a short note on Cache Memory.

Processor obtains data and instructions from RAM during data processing. Often processor obtains same data or instructions from RAM again and again (or repeatedly). In this way, a lot of time of processor is wasted for obtaining same data or instructions from memory. So performance of processor is affected. Cache memory is a very small but very fast memory. It is used to improve the performance of the processor (or computer system). Some cache memories are built inside processor (CPU) and some are separate chips on motherboard and are located between RAM and CPU. CPU stores frequently used instructions and data in cache memory. When CPU needs a specific data or program instruction, it quickly obtains from cache memory. So cache memory speeds up the working of CPU

Q. Write a note on Flash Memory.

Flash memory is a type of non-volatile memory. It can be erased electronically and rewritten like EEPROM. Most computers use flash memory to store startup instructions. Flash memory chips are also used in mobile computers and peripherals devices to store data and programs. These mobile computers and devices include PDAs, smartphones, tablets, portable media players, printers, digital cameras, digital voice recorders, etc. For example, when you enter names and addresses into smartphones, a flash memory chip stores the data. Some portable media players store music on flash memory chips; others store music in memory cards. Memory cards contain flash memory on a removable device instead of a chip.