# UNIT-02

MEMORY

INTRODUCTION

- Memory is the most essential element of a computing system because without it computer can't perform simple tasks.
- A memory is just like a human brain. It is used to store data and instructions.
- Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored.
- Computer memory is of two basic types – Primary memory (RAM and ROM) and secondary memory (hard drive, cd, etc).
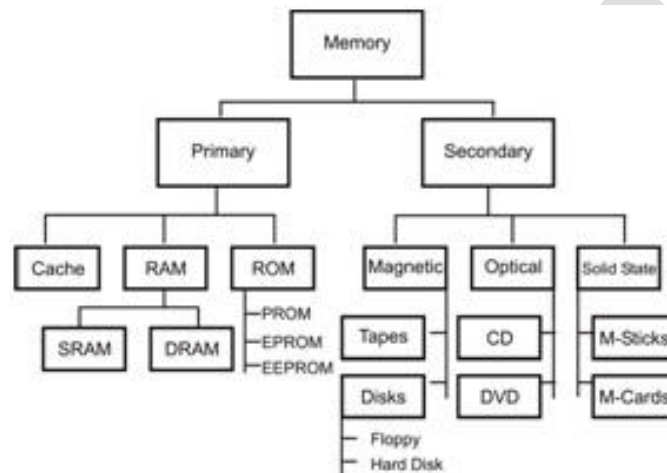
PRIMARY MEMORY

CACHE MEMORY

- Cache memory is a very high speed semiconductor memory which can speed up CPU.
- It acts as a buffer between the CPU and main memory.
- It is used to hold those parts of data and program which are most frequently used by CPU.
- The parts of data and programs are transferred from disk to cache memory by operating system, from where CPU can access them.
- Advantages
  - Cache memory is faster than main memory.
  - It consumes less access time as compared to main memory.

- It stores the program that can be executed within a short period of time.
- It stores data for temporary use.
  - Disadvantages
    - Cache memory has limited capacity.
    - It is very expensive.

RANDOM ACCESS MEMORY (RAM)

- It is also called read-write memory or the main memory or the primary memory.
- The programs and data that the CPU requires during the execution of a program are stored in this memory.
- It is a volatile memory as the data lost when the power is turned off.
- It is very expensive compared to all types of secondary memory in terms of cost per gigabyte.
- RAM is further classified into two types
  1. **SRAM (Static Random Access Memory)**
     - The word static indicates that the memory retains its contents as long as power remains applied.
     - However, data is lost when the power gets down due to volatile nature.
     - SRAM chips use a matrix of 6-transistors and no capacitors.
     - Transistors do not require power to prevent leakage, so SRAM need not have to be refreshed on a regular basis.
     - SRAM is faster but also more expensive.
     - It is typically used for the cache and internal registers of a CPU.
  2. **DRAM (Dynamic Random Access Memory).**
     - DRAM, unlike SRAM, must be continually refreshed in order for it to maintain the data.
     - This is done by placing the memory on a refresh circuit that rewrites the data several hundred times per second.
     - DRAM is used for most system memory because it is cheap and small.
     - All DRAMs are made up of memory cells. These cells are composed of one capacitor and one transistor.

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 instruction as are required to start computer when electricity is first turned on, this operation is referred to as bootstrap.
- ROM chip are not only used in the computer but also in other electronic items like washing machine and microwave oven.
- Following are the varioys types of ROM

  ### 1. MROM (Masked ROM)
  - The very first ROMs were hard-wired devices that contained a pre-programmed set of data or instructions.
  - These kind of ROMs are known as masked ROMs.
  - It is inexpensive ROM.

  ### 2. 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 programmer.
  - Inside the PROM chip there are small fuses which are burnt open during programming.
  - It can be programmed only once and is not erasable.

  ### 3. EPROM(Erasable and Programmable Read Only Memory)
  - The EPROM can be erased by exposing it to ultra-violet light for a duration of upto 40 minutes.
  - During programming an electrical charge is trapped in an insulated gate region. The charge is retained for more than ten 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.
- This is a non-volatile memory type i.e. it retains data even when the power is switched off.

4. EEPROM(Electrically Erasable and Programmable Read Only Memory)
- The 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 (milli second).
- 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.

SECONDARY MEMORY

- Secondary Memory is also called "storage device" and "auxiliary memory", "external memory".
- Secondary storage devices are volatile in nature, it means that data does not discard while power turn-off, in which all data store for long time.
- Secondary memory has the speed of access of data is very slow compare to primary memory, and cheaper as well.
- Without primary memory, those secondary storage devices are useless because for processing the secondary memory must be needed the primary memory, first of all data are transferred into primary memory then these data make for executable.
- Secondary memory (Storage Devices) can be used in computer either internally or externally.
- Secondary Storage devices (memory) have four examples like as

    - Magnetic storage devices
    - Optical storage devices
    - Solid state storage devices

MAGNETIC STORAGE DEVICES

- Magnetic storage is also known as "Magnetic Media" or "Magnetic Memory" or "Magnetic Medium".

- In the Magnetic storage devices, all data are stored with using magnetized medium, and those types of data saved in that medium in the binary form like as 0 and 1.
- This magnetic storage has also non-volatile storage nature.
- Magnetic storage devices have huge capacities for storing data that it's more attractive point. These storage devices are not more costly but their data accessing power is slow
- There are different types of magnetic storage medium (device):

1. Hard Disk drive

- A computer hard drive (or a hard disk or HDD) is one kind of technology that stores the operating system, applications, and data files such a documents, pictures and music that your computer uses.
- Hard-drives have a very large storage capacity (up to 1TB). They can be used to store vast amounts of data.
- Both surfaces of each disk are capable of storing data except the top and bottom disk where only the inner surface is used.
- These disks move very higher speed (5500 to 7500 RPM), so any data can be retrieved immediately from any area on the hard drive.
- In Hard Drive, All data does not discard after getting to discontinue power supply.

2. Floppy Disk

- A floppy disk or floppy diskette is a type of disk storage composed of a thin and flexible disk of a magnetic storage medium in a square or nearly square plastic enclosure lined with a fabric that removes dust particles from the spinning disk.
- Floppy disks store digital data which can be read and written when the disk is inserted into a floppy disk drive (FDD) connected to or inside a computer or other device.

- A removable, portable, cheap, low-capacity (1.44MB) storage medium. Floppy discs are random access devices used for transfer small amounts of data between computers, or to back-up small files, etc.
- Almost every PC used to have a floppy disc drive. These are obsolete now, having been replaced by higher capacity technology such as CD-ROMs, DVDs and USB memory sticks.

3. Zip Disc

- A removable and portable storage medium, similar in appearance to a floppy disk, but with a much higher capacity (100MB, 250MB or 750MB).
- Zip discs are random access devices which were used for data back-up or moving large files between computers.
- Another obsolete storage device, zip discs were a popular replacement for floppy discs for a few years, but they never caught on fully before being superseded by cheaper media like CD-ROMs and CD-Rs

OPTICAL STORAGE DEVICES

- Optical storage is also known as "Optical Media" or "Optical Memory" or "Optical Medium", and it allows all read and write activities which are performed by laser beam.
- It is a storage device in which optical (light) energy is used.
- Their big advantages are not more costly, light weight, and easy to transport because it is removable device unlike hard drive.
- **WHY TO USE OPTICAL STORAGE**
  - In the **optical storage devices**, all data is saved like as patterns of dots which can be easily read with using of LIGHT. Laser Beam is used like as "Light Source".
  - The data is read while bouncing laser beam on the surface of **storage medium**. Laser beam creates the all Dots while reading process, but it is used with high power mode to mark the surface of storage device, and make a dot. This entire process is also called the "Burning" data onto Disc.
- **TYPES OF OPTICAL STORAGE DEVICES**
  - ♦ **Read-Only Optical Discs**
    - **CD-ROM**
      - Compact Disc - Read-Only Memory (CD-ROM) discs can hold around 800MB of data.
      - The data cannot be altered (non-volatile), so cannot be accidently deleted. CD-ROMs are random-access devices.
      - CD-ROMs are used to distribute all sorts of data: software (e.g. office applications or games), music, electronic books (e.g. an encyclopaedia with sound and video.)
    - **DVD-ROM**
      - Digital Versatile Disc - Read-Only Memory (DVD-ROM) discs can hold around 4.7GB of data (a dual-layer DVD can hold twice that). DVD-ROMs are random-access devices.
      - DVD-ROMs are used in the same way as CD-ROMs (see above) but, since they can hold more data, they are also used to store high-quality video.
  - ♦ **High Capacity Optical Discs**
    - **Blu-Ray**
      - Blu-Ray disks are a recent replacement for DVDs.
      - A Blu-Ray disc can hold 25 - 50GB of data (a dual-layer Blu-Ray disc can hold twice that). Blu-Ray discs are random-access devices.

- Blu-Ray discs are used in the same way as DVD-ROMs (see above) but, since they can hold more data, they are also used to store very high-quality, high-definition (HD) video.
  - **HD DVD**
    - High-density DVD (HD-DVD) discs can hold around 15GB of data (a dual-layer HD-DVD can hold twice that). HD-DVDs are random-access devices.
    - HD-DVD discs are used in the same way as DVD-ROMs but, since they can hold more data, they are also used to store very high-quality, high-definition (HD) video.

♦ **Recordable Optical Discs**

Recordable optical discs can have data written onto them ('burnt') by a computer user using a special disc drive (a disc 'burner').

- **CD-R and DVD-R**
  - CD-Recordable (CD-R) and DVD-recordable (DVD-R) discs can have data burnt onto them, but not erased. You can keep adding data until the disc is full, but you cannot remove any data or re-use a full disc.
- **CD-RW and DVD-RW**
  - CD-ReWritable (CD-RW) and DVD-ReWritable (DVD-RW) discs, unlike CD-Rs and DVD-Rs, can have data burnt onto them and also erased so that the discs can be re-used.

FLASH MEMORY

- **Flash Memory** was introduced by Dr. Fujio Masuoka in 1980.
- Flash memory is also known as electronically erasable programmable read only memory (EEPROM), because in which piece of code like as programming can be write and erased by electrically.
- Flash memory also uses for the storing data to computers as well as electronic devices such as USB flash drives, MP3 players, digital cameras and solid-state drives.
- Flash memory is non-volatile in nature because all data are persisted in the memory when power is turn-off.
- **EXAMPLES OF FLASH MEMORY**
  ### 1. USB Flash Drive
  - USB flash drive is also known as USB thumb drive, USB stick or Pen drive. It is light weight portable storage device, and it is used as ""Plug and Play.

2. Memory Card

- Memory card is also known as "Flash Memory Card", and it is storage medium of different types of data such as images, video or text.
- Memory card is mostly used into several devices such as digital camcorders, handheld computers, MP3 players, printer, digital cameras and more.

3. SSD

- SSD stands for "Solid-State Drive", and it is data storage medium.
- SSD is a non-volatile memory to store and access any types of data.
- It does not contain any moving parts, so it delivers the faster access time, noiseless operation, higher reliability, and lower power consumption.