



EXPERIMENT 1.3

Name: _____

UID: _____

Branch: BE-CSE

Section: _____

Semester: 2nd

Objective: Draw a labelled sketch of Hard Disk. Explain the working principle of hard disk, also explain Spindle, Cluster, Sector, Track, Read-Write Head, Arm, Platter, Rotational Latency, Seek Time, Data Transfer Time and Average Access Time.

Material Required: Plain A-4 size Sheet, Pen.

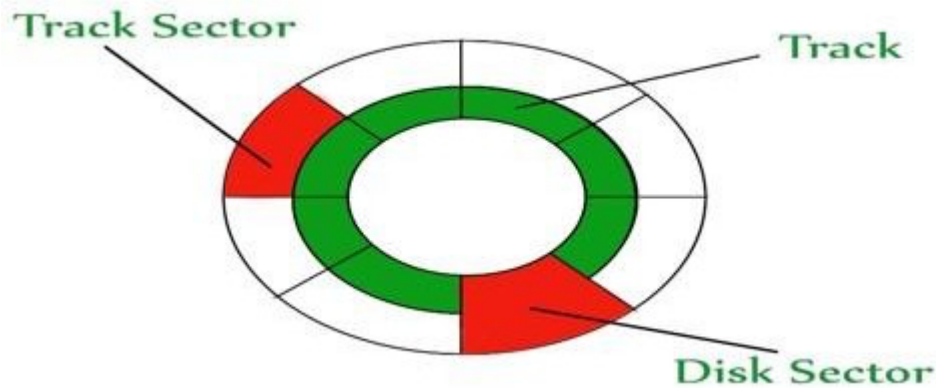
Hard disk drive (HDD) - is a kind of mechanical device memory where data is encoded in the form of magnetic impulses on platters covered with magnetizing ferromagnetic material.



The typical HDD consists of: stepper and linear motors, read-and-write heads, platters and disk controller. The controller includes central processing unit, RAM and ROM memories and

data amplifiers circuits. Communication between CPU and HDD requires transmission of data, commands (to appropriate registers of HDD controller) and status words.

A hard disk is a memory storage device which looks like this:



The disk is divided into tracks. Each track is further divided into sectors. The point to be noted here is that outer tracks are bigger in size than the inner tracks but they contain the same number of sectors and have equal storage capacity. This is because the storage density is high in sectors of the inner tracks whereas the bits are sparsely arranged in sectors of the outer tracks. Some space of every sector is used for formatting. So, the actual capacity of a sector is less than the given capacity.

Structure of HDD-

Platters:

A platter is a circular magnetic plate that is used for storing data in a hard disk. It is often made of aluminium, glass substrate or ceramic. A hard disk drive contains several platters that are mounted on the same spindle. The platters rotate when the hard disk is performing read/write operations; the rotations per minute depend on the hard disk model. The platter is very sensitive, and any contamination can often make the affected area unreadable, leading to data loss. The platter is capable of holding large amount of data.



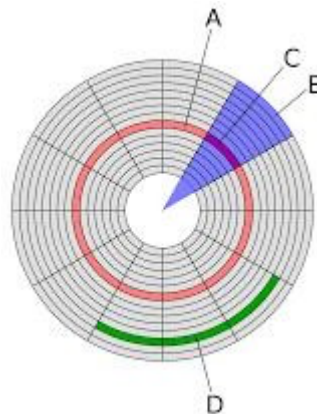
SPINDLE:

A spindle is a shaft that holds rotating hard disk drive (HDD) platters in place. The term is also often used to refer to a single HDD. Spindle speed, measured in rotations per minute (RPM), is one metric used to gauge disk drive performance.



TRACK:

A track is that portion of a disk which passes under a single stationary head during a disk rotation, a ring 1 bit wide. A cylinder is comprised of the set of tracks described by all the heads (on separate platters) at a single seek position. Each cylinder is equidistant from the centre of the disk.



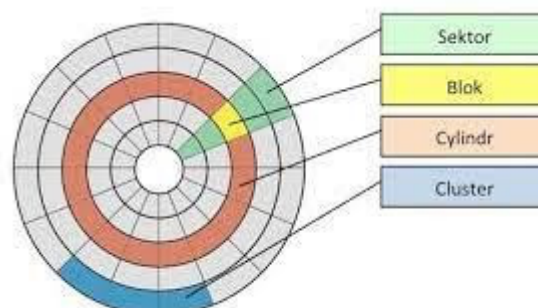
SECTOR:

A sector is the smallest unit that can be accessed on a hard disk. Each platter, or circular disk of a hard disk is divided into tracks, which run around the disk. These tracks get longer as they move from the middle towards the outside of the disk, so there are more sectors along the tracks near the outside of the disk than the ones towards the centre of disk. This variance in sectors per track is referred to as "zoned-bit recording."

CLUSTER:

A cluster is the smallest logical amount of disk space that can be allocated to hold a file. Storing small files on a file system with large clusters will therefore waste disk space; such

wasted disk space is called cluster sizes which are small file size, the wasted space per statistically about half of the cluster sizes, the wasted space



slack space. For versus the average file will be cluster size; for large will become greater.

However, a larger cluster size reduces bookkeeping overhead and fragmentation, which may improve reading and writing speed overall. Typical cluster sizes range from 1 sector (512 B) to 128 sectors (64 KB).

Read-Write(R-W)

Head moves over the rotating hard disk. It is this Read-Write head that performs all the read and write operations on the disk and hence, position of the R-W head is a major concern. To perform a read or write operation on a memory location, we need to place the R-W head over that position. Some important terms must be noted here:

Seek time – The time taken by the R-W head to reach the desired track from its current position.

Rotational latency – Time taken by the sector to come under the R-W head.

Data transfer time – Time taken to transfer the required amount of data. It depends upon the rotational speed.

Controller time – The processing time taken by the controller.

Average Access time – seek time + Average Rotational latency + data transfer time + controller time.