

## SYLLABUS

# Programming For Problem Solving

### Module - 1 :

- (a) Introduction to Components of a Computer System :- Memory, Processor, I/O devices, Storage, Operating System, Concept of assembler, Compiler, interpreter & loader, linker.
- (b) Idea of Algorithm : Representation of algorithm, Flow chart, Pseudocode with examples, from algorithm to programs, Source Code.
- (c) Structure of C Programs : Writing & executing the C Programs, Syntax & logical errors in Compilation, object and executable Code.
- (d) Components of C language : Standard I/O in C, fundamentals data types, Variables and Memory locations, Storage classes.

### Module - 2 :

- (a) Arithmetic expression & Precedence : Operator and expression using numeric & relational operators, Mixed operands, type Conversion, logical operators, Bit operations, assignment operator, operator precedence & associativity.

(b) Conditional Branching : Applying if else with Statement, Nesting if and else, Use of break & default in Switch Statement.

### Module - 3 :

(a) Iteration and loops : Use of while, Do while & for loops, Multiple loop variables, Use of Break & Continue Statement.

(b) Function : Introduction, Types of functions, Function with array, Passing parameters to function, Call by Value, Call by reference, Recursive function.

### Module - 4 :

(a) Arrays : Array notation & representation, Manipulating array elements, Using multidimensional arrays, Character arrays & Strings, Structure, Union, Nested data types, array Structures, Passing arrays to function.

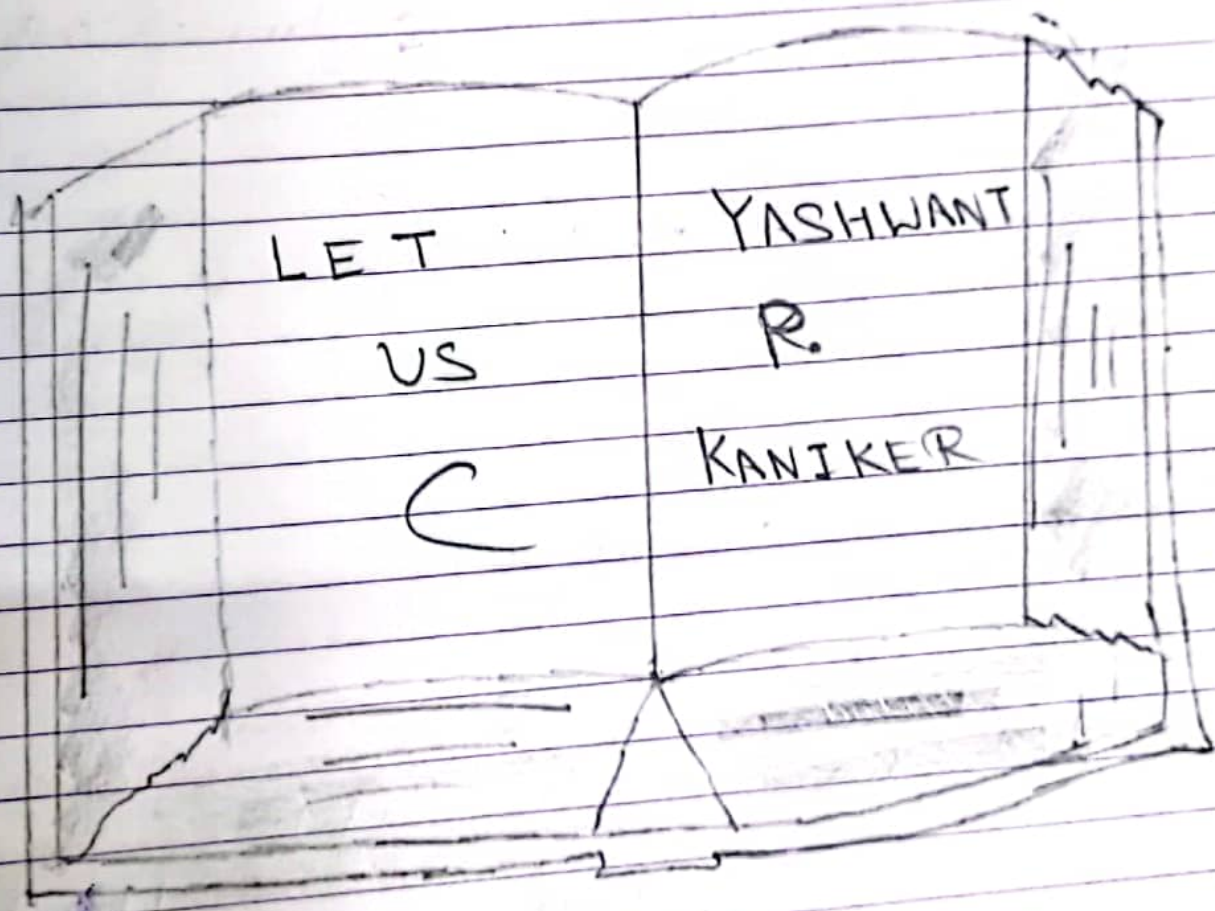
(b) Basic Algorithms : Searching & Basics, Sorting algorithm (Bubble, insertion & Selection), Finding roots of equation, notion of order of Complexity.

### Module - 5 :

(a) Pointers : Introduction, Declaration, Application, Introduction to dynamic memory allocation (MALLOC, CALLOC, REALLOC, FREE), Use of pointers in self-referential

Structure, Notion of linked list (No implementation).

(b) File Handling : File I/O function, Standard C Preprocessor, defining & Calling Macros in C, Command line arguments.



Date

22/8/22

## Introduction to Components of a Computer System:

**Computer :-** A Computer is an electronic device which takes data & instruction as input, stores them, processes them & gives meaningful results as output which can also be termed as information.

Input → Store → Processing → Store → output

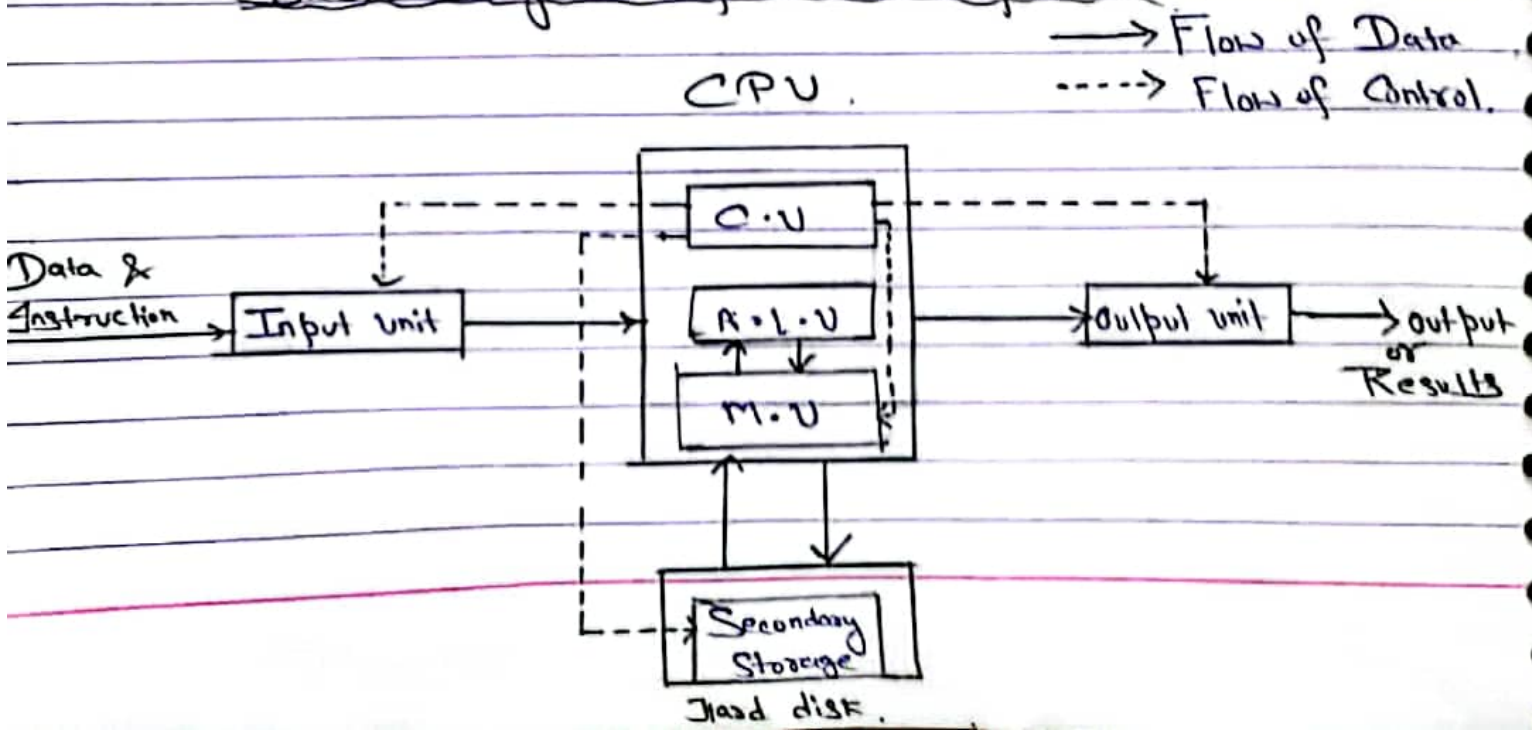
### Function of a Computer:

- 1. Storage
- 2. Processing
- 3. Output
- 4. Input
- 5. Controlling

### Components of a Computer:

- (i) Hardware
- (ii) Software

### Block diagram of a Computer.



Central processing unit (CPU) :- It is called "the Brain of Computer" as it controls operation of all parts of Computer. It consists of three components: Control unit (CU), Arithmetic logic unit (A.L.U), Memory unit (M.U).

Control unit (CU) :- This part of CPU extracts instructions, performs execution, maintains & directs operations of entire system.

It performs following function:

- ① Controls all activities of Computer.
- ② Supervises flow of data within CPU.
- ③ Directs flow of data within CPU.
- ④ Transfers data to arithmetic & logic unit.
- ⑤ Transfers results to memory.
- ⑥ Fetches results from memory to output devices.

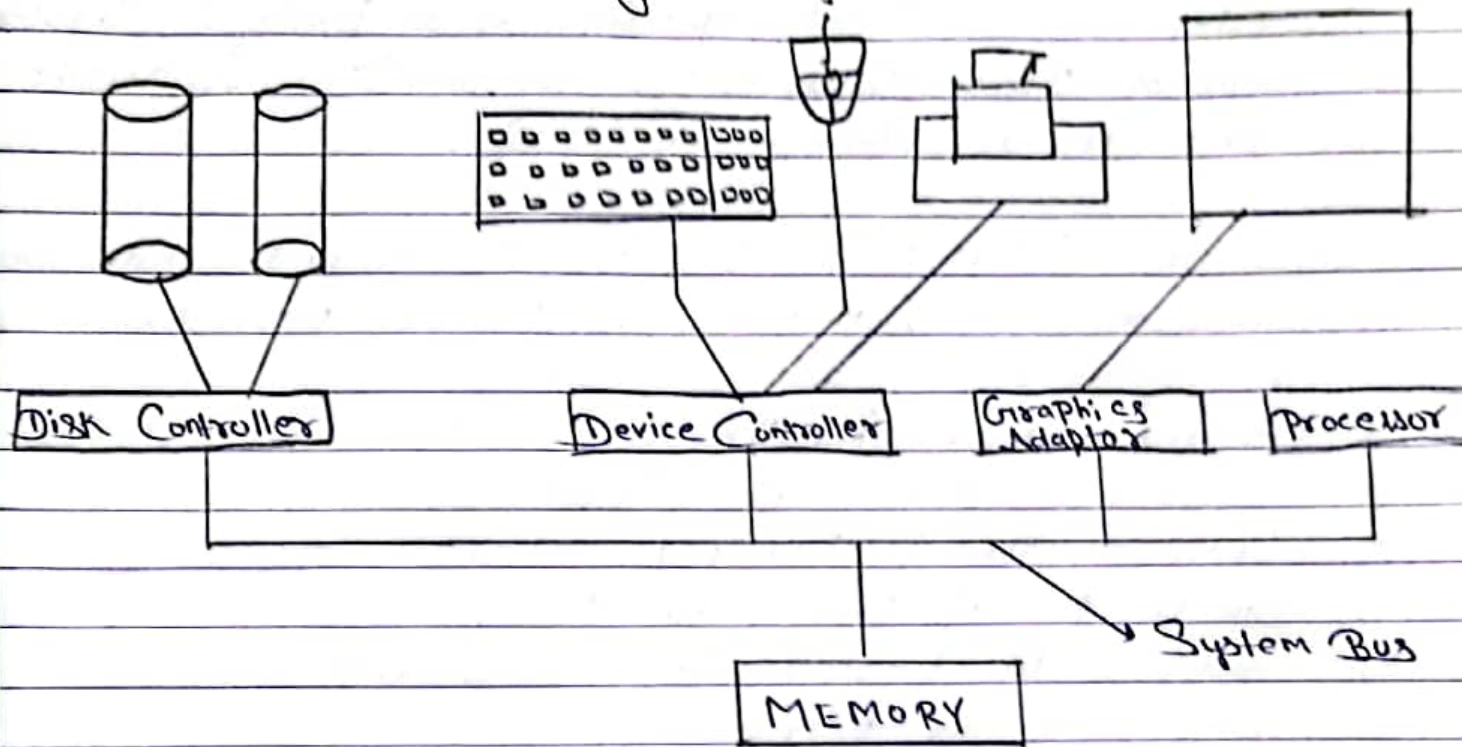
Arithmetic logic unit (ALU) :- Data entered into Computer is sent to RAM, from where it is then sent to ALU, where rest of data processing takes place. All types of processing such as comparisons, decision making & processing of non-numeric information takes place here & once again data is moved to RAM.

Memory unit (MU) :- This is unit in which data & instructions given to Computer as well as results given by Computer are stored.

\* Unit of memory is "Byte".

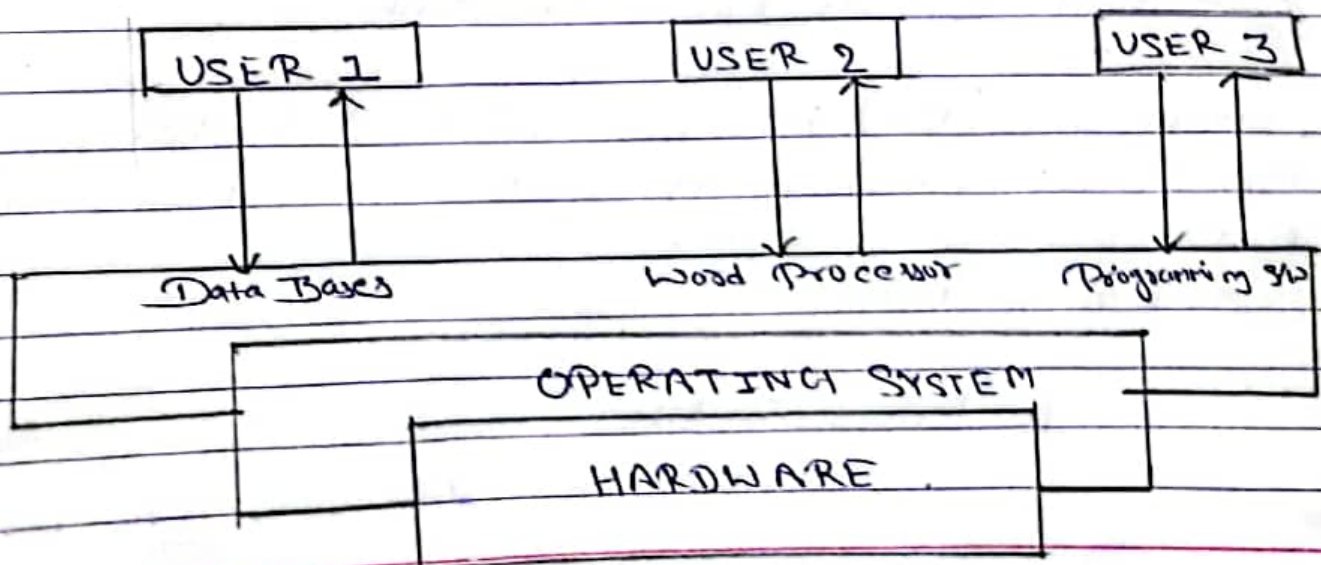
$$1 \text{ Byte} = 8 \text{ Bits}$$

# A Modern Day Computer



## Components of Computer System :-

- ① Hardware
- ② Software
- ③ People/users
- ④ Data



Database → A database is an organized collection of structured information, or data typically stored electronically in a computer system.

Word processor → A word processor is a type of software application used for composing, editing, formatting & printing documents.

Programming Software → It is a software which helps the programmer in developing other software. Compilers, assemblers, debuggers, interpreters etc. are examples of programming software.

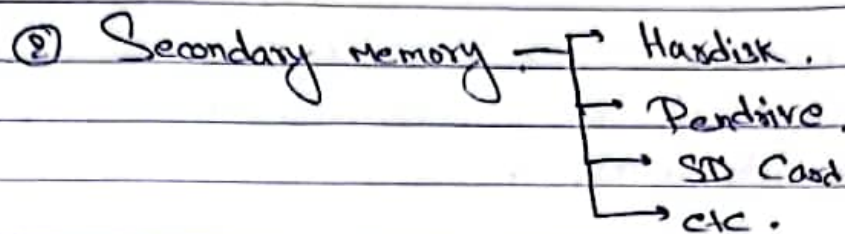
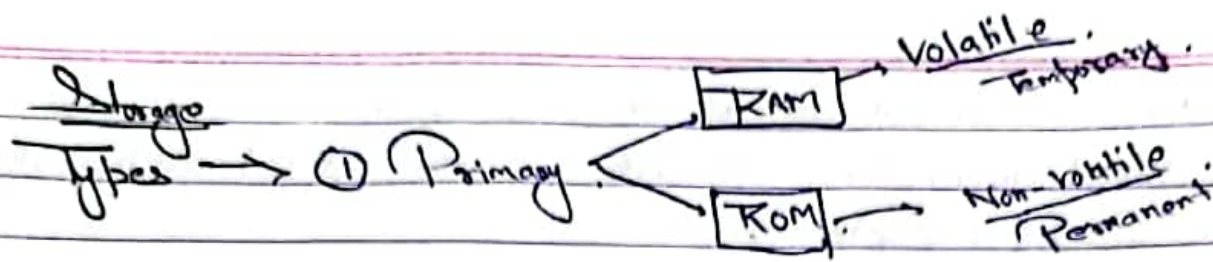
Operating System → operating system is a software that controls system's hardware & interacts with user and application software.

## Memory and Storage

Memory : Computer memory is just like a human brain. It is used to store data/information & instruction. It can store both input & output can be stored here.

### Characteristics of main memory :

- ① It is faster computer memory as compare to secondary memory.
- ② It is semiconductor memories.
- ③ It is usually a volatile memory.
- ④ It is main memory of the computer.
- ⑤ A computer system cannot run without primary memory.



1. Primary memory : It is also known as main memory of the Computer System. It is used to store data and programs or instruction during Computer operation. It uses Semiconductor technology & hence is commonly called Semiconductor memory.

(a) RAM → It is a volatile memory, it stores information based on the power supply. If the power supply fails / interrupted / stopped, all the data & information on this memory will be lost. Ram is used for booting up or start the Computer. It temporarily stores program / data.

Two types

① SRAM (Static RAM)

② DRAM (Dynamic RAM)

2. Secondary Memory : It is also known as Auxiliary memory and backup memory. It is non-volatile memory & used to store a large amount of data or information. The data or information stored in Secondary memory is permanent, & it is slower than primary memory. A CPU cannot access Secondary memory directly. The data or information from the auxiliary memory is first transferred to the main memory & then CPU can access it.



3. Cache Memory : It is type of high speed semiconductor memory that can help the CPU run faster. Between the CPU and the main memory, it serves as a buffer. It is used to store data & programs that the CPU uses the most frequently.

Advantage →

- ① It is faster than the main memory.
- ② It takes less time to access as compared to the main memory.
- ③ It keeps the program that can run in short amount of time.
- ④ It stores data in temporary use.

Disadvantage →

- ① Because of semiconductor, it is very expensive.
- ② Size is small.

### Volatile & Non-Volatile Memory

Volatile memory is used to store information based on power supply. If power supply is off, all the data & information on this computer will be lost. For example, RAM (Random Access memory).

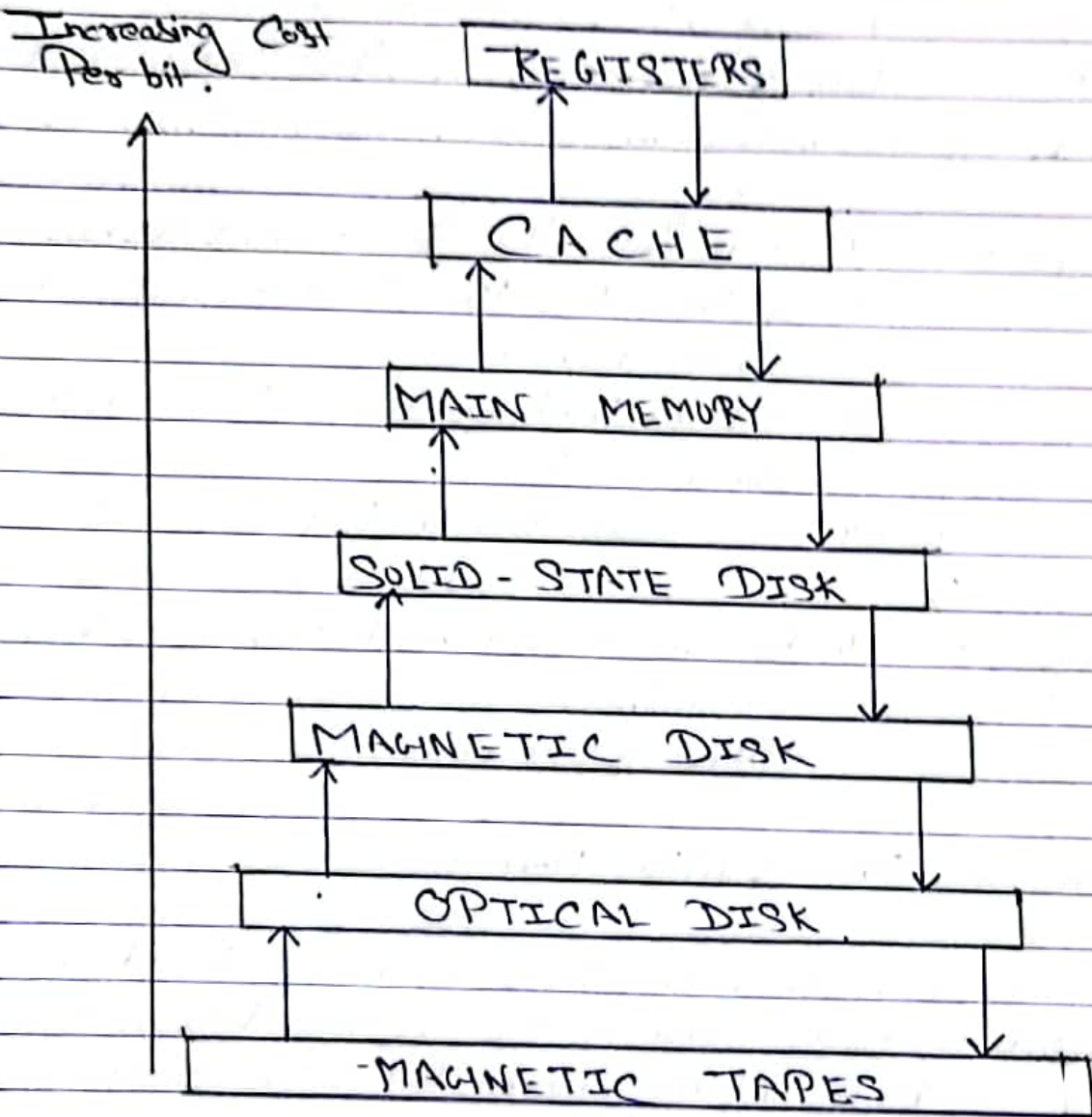
Whereas non-volatile memory is used to store information even when the power supply is off. For example, ROM (Read only memory).

### Criteria for Storage division :

- ① Access time - the time require to locate.
- ② Cost per bit's storage
- ③ Storage Capacity.

$$\boxed{\text{Cost} \uparrow \propto \frac{1}{\text{Storage} \downarrow}}$$

## Memory Hierarchy

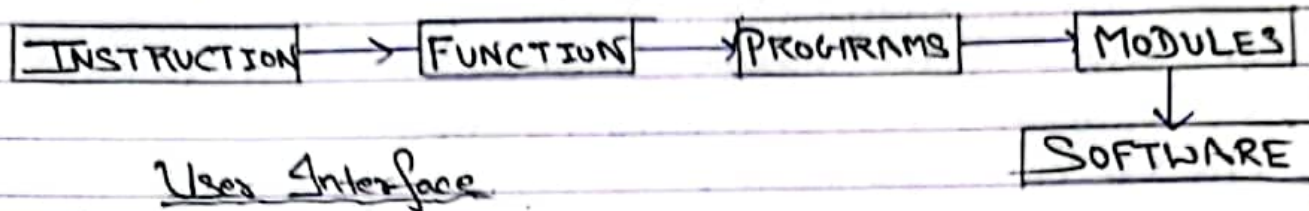


## Operating System :

It has many definition, In general operating system is a huge software that manage computer to hardware & also performs various function. It provides an environment in which a user can execute programs conveniently & efficiently. It acts as a intermediate between user of a computer & hardware. It provides GUI (Graphic user Interface) i.e Desktop, Icons.

## Views of operating System :

- ① user view
- ② System or hardware view.



### User Interface

- ① user.
- ② System or application programs
- ③ operating system
- ④ hardware

## Components of operating System :-

- ① Process management → related to CPU
- ② Memory management → related to RAM
- ③ Input / output Management
- ④ File Management
- ⑤ Secondary Storage management
- ⑥ Security
- ⑦ Command Interpreter.

1. Process Management : In multiprogramming environment, the OS decides which process gets the processor when & for how much time.

→ Keeps tracks of processor & status of process.

→ Allocates the processor (CPU) to a process.

→ De-allocates processor when a process is no longer required.

2. Memory Management : Memory management refers to management of primary memory (RAM) or main memory.

- Keeps tracks of primary memory i.e. what part of it are in use by whom, what part are not in use.
- In multiprogramming, the OS decides which process will get memory when & how much.
- Allocates the memory when a process requests it to do so.
- De-allocates the memory when a process no longer needs it or has been terminated.

3. I/O Management: I/O Device management provides an abstract level of I/O devices & keep the details from application to ensure proper use of devices, to prevent errors, & to provide users with convenient & efficient programming environment.

- Hide the details of I/O devices
- Manage main memory for the devices using Cache, buffer, & spooling.
- Maintain & provide custom drivers for each device.

4. File Management: It is one of the visible services of an operating system. Mostly files represent data, source & object forms, & programs. Data files can be any type like alphabetic, numeric, & alphanumeric.

- File Creation and deletion.
- Directory Creation & deletion.
- The support of primitives for manipulating files & directories.
- Mapping files onto secondary storage.
- file backup & recovery.

5. Secondary Storage Management: Most programs, like compilers, assemblers, sort routines, editors, formatters & so on, are stored on the disk until loaded into memory, &

then use the disk as both the source & destination of their processing.

→ Free Space Management

→ Storage allocation.

6. Security : The operative system is primarily responsible for all task & activities happen in the Computer system. The various processes in an operating system must be protected from each other's activities.

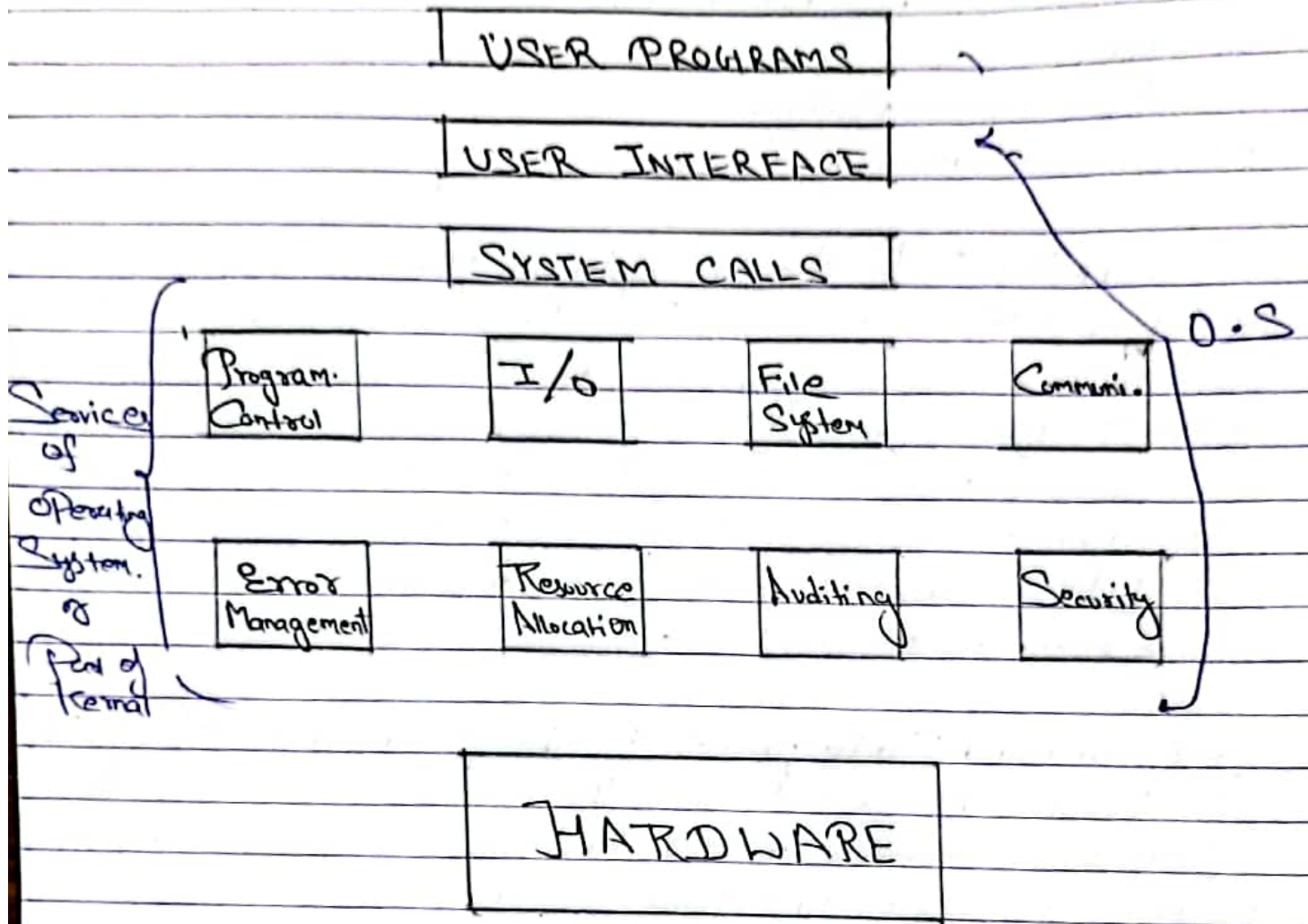
→ Security Management refers to a mechanism for controlling the access of programs, processes or users to the resources defined by a computer's control to be imposed, together with some means of enforcement.

7. Command Interpreter : The Command interpreter is the primary interface between the user & the rest of the system. It executes a user's command by calling one or more number of underlying system programs or system calls.

→ Command interpreter system allows human users to interact with the operating system & provides convenient programming environment to the users.

## System Calls

System Call is the special function i.e. used by the process to request action (or services) from the operating system which cannot be carried out by normal function. System calls provide the end-face between the process & the operating system.



When the process is being run, if the process required certain action which need to be carried out by OS, the process has to go called the function which can interact with the kernel to complete the actions. The special type of function call is known as system calls in OS. System calls provide the interface so that the process can communicate with the operating system.

Note: Kernel is the core component of the operating system that has complete control of the hardware.

## Types of System Calls

There are mainly five types of System Calls Available:  
They are as follows :-

- ① Process Control → It handles the System Calls for process Creation, deletion, etc.  
ex load, execute, abort, wait signal events for process.
- ② File Management → File Manipulation events like Creating, deleting, reading & writing etc are being classified Under file Management System Calls.
- ③ Device Management → This System Calls are being used to request the device, release the device, logically attached & detached the device.
- ④ Information Maintenance → This type of System Call is used to maintain the information about the system like time & date.
- ⑤ Communication → In order to have Interprocess Communications like send or receive the message, create or delete the Communication Connection, & to transverse status information etc, Communication System Calls are used.