



KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY (KIIT)

Deemed to be University U/S 3 of UGC Act, 1956

# Computer Programming Language Lab

Autumn Semester 2022-2023  
School of Computer Engineering  
**Course Code** - CS-1093

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School of Computer Engineering  
KIIT Deemed to be University



# General Instructions

## Attendance:

- Attendance is required in all labs without exception. There are no make-up labs in this course.
- The student will not be allowed for exam if he/she is found short of attendance and has not completed all the experiments.
- Performance will be judged based on the experiments, quality and punctual submission of the labs reports for each experiment.

## Lab Report:

- Every student has to submit the laboratory report/assignments on the scheduled dates.
- While entering into the LAB everyone should wear the ID cards.
- During the lab nobody will be allowed to use the mobile phones.
- Everyone is advised to shut down the system after finishing the experiments.



# Credit Points and Marks Distribution

- L-T-P - 0-2-4 (6 Credit Points)
- The entire lab course consists of 100 marks.

Continuous Evaluation marks	60
End Sem Lab Examination	40
<b>Total</b>	<b>100</b>

Continuous Evaluation	
Program & Execution	5
Observation	3
Viva	2
<b>Total</b>	<b>10</b>

End Sem Lab Examination	
Write-up of program	15
Program execution & Checking Result for all inputs	15
Final Viva	10
<b>Total</b>	<b>40</b>



# Course Content

Module	Theory
Introduction	Introduction to computer Fundamentals, memory Flowchart, algorithm, Number system representation (Binary-decimal)
Variables, constants, Data types, Operators	Types of variables and constants Console input/output operations (library functions) Operators Type casting
Control Statements	Decisions control and branching statements
Array	Introduction to Array
Function	Library & User defined Functions, Formal and Actual parameters Declaring, defining and calling functions



# Course Content

Module	Theory
Functions Storage class	Parameter Passing – call-by-value and call-by-reference, Recursion Storage class
Character Arrays /Strings	String Manipulation functions
Pointer, Dynamic Memory Allocation	Pointer variable, Pointer Arithmetic, Passing parameters by reference, Pointer to pointer, Pointer to functions, Memory allocation functions (malloc, calloc, realloc, etc.) Memory de-allocation function (free)
User Defined Data Types – Structures and Unions	Structure: definition, structure variable, creation, initialization and assignment, Pointers to structures, Union and their uses, Enum and their uses
File Handling	File operations - opening, closing, reading, writing etc. Command line arguments, Bitwise operators, Macros

**Text books:** Programming in ANSI C (Latest Edition) by E. Balagurusamy

**Reference books:** The C Programming Language by Brian Kernighan and Dennis Ritchie (Second Edition)



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# COMPUTER FUNDAMENTALS

# CONTENTS

- What is a computer
- Why computers
- Disadvantages
- Use of computers

# WHAT IS A COMPUTER?

- A computer is an electronic device that accepts raw data as input and processes it with a set of instructions (a program) to produce the result as output.
- It produces the results in the form of information or signals.
- It shows output just after performing mathematical and logical operations.
- It also has a memory that stores the data, programs, and result of processing.





# WHAT DOES COMPUTER DO?

- A computer is an electronic data processing device, which accepts and stores data input, processes the data input, and generates the output in a required format.



# WHY COMPUTERS ?

- **High Speed**

- Computer is a very fast device.
- It is capable of performing calculation of very large amount of data.
- It can perform millions of calculations in a few seconds as compared to man who will spend many months to perform the same task.

- **Accuracy**

- In addition to being very fast, computers are very accurate.
- Computers perform all jobs with 100% accuracy provided that the input is correct.

- **Storage Capability**

- Memory is a very important characteristic of computers.
- A computer has much more storage capacity than human beings.
- It can store large amount of data.
- It can store any type of data such as images, videos, text, audio, etc.

# WHY COMPUTERS ?

## MORE REASONS

- **Diligence**

- Unlike human beings, a computer is free from monotony, tiredness, and lack of concentration.
- It can work continuously without any error and boredom.
- It can perform repeated tasks with the same speed and accuracy.

- **Versatility**

- A computer is a very versatile machine.
- A computer is very flexible in performing the jobs to be done.
- This machine can be used to solve the problems related to various fields.
- At one instance, it may be solving a complex scientific problem and the very next moment it may be playing a card game.

- **Reliability**

- A computer is a reliable machine.
- Modern electronic components have long lives.
- Computers are designed to make maintenance easy.

# WHY COMPUTERS ?

## MORE REASONS

- **Automation**

- Computer is an automatic machine.
- Automation is the ability to perform a given task automatically. Once the computer receives a program i.e., the program is stored in the computer memory, then the program and instruction can control the program execution without human interaction.

- **Reduction in Paper Work and Cost**

- The use of computers for data processing in an organization leads to reduction in paper work and results in speeding up the process.
- As data in electronic files can be retrieved as and when required, the problem of maintenance of large number of paper files gets reduced.
- Though the initial investment for installing a computer is high, it substantially reduces the cost of each of its transaction.

# DISADVANTAGES

- **No I.Q.**
  - A computer is a machine that has no intelligence to perform any task.
  - Each instruction has to be given to the computer.
  - A computer cannot take any decision on its own.
- **Dependency**
  - It functions as per the user's instruction, thus it is fully dependent on humans.
- **Environment**
  - The operating environment of the computer should be dust free and suitable.
- **No Feelings**
  - Computers have no feelings or emotions.
  - It cannot make judgment based on feeling, taste, experience, and knowledge unlike humans.

# USE OF COMPUTERS

- **Business**

- Budgeting
- Sales analysis
- Financial forecasting
- Managing employee database
- Maintenance of stocks, etc

- **Banking**

- Keeping Employees record
- Keeping Transaction History



# USE OF COMPUTERS

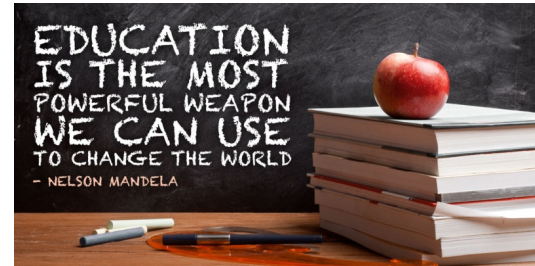
- **Insurance**

- Starting date of the policies
- Next due installment of a policy
- Maturity date
- Interests due
- Benefits
- Bonus



- **Education**

- Keep students' records
- Computer based learning
- Admission process
- Placement centre



# USE OF COMPUTERS

- **Health care**

- Medical and Patient Data
- Patient monitoring system
- Hospital administration
- Pharma information system



- **Engineering design**

- Structural engineering
- Architectural engineering
- Industrial engineering





# USE OF COMPUTERS

- **Military**
  - Missile Control
  - Military Communication
  - Military Operation and Planning
  - Smart Weapons
- **Communication and social media**
  - Email
  - Facebook
  - Twitter
  - Video conferencing
  - Whatsapp



# USE OF COMPUTERS

- **Government Services**
  - Budgets
  - Income tax department
  - Computation of male/female ratio
  - Computerization of voters lists
  - Computerization of PAN card
  - Weather forecasting

# CONTENTS - 2

- Generations of computer
- Classification of computer
- Anatomy of computer
  - Hardware
    - Input devices
    - Output devices
    - CPU
    - Memory Unit
  - Software
- Units of memory

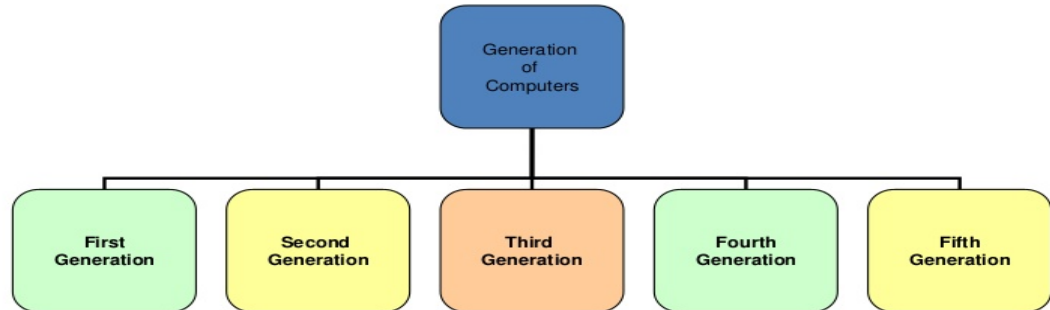
# GENERATION OF COMPUTERS

# GENERATION OF COMPUTERS

- Generation in computer terminology is a change in technology a computer is/was being used.
- Initially, the generation term was used to distinguish between varying hardware technologies.
- Nowadays, generation includes both **hardware and software**, which together make up an entire computer system.

## Generation of Computers

Based on the characteristics of various computers developed from time to time, they are categorized as generation of computers.



# GENERATION OF COMPUTERS

Gen #	Technology	Operating System	Year of Introduction	Specific Computers
1	Vacuum Tube (Heavy and large)	None (Machine Language)	1945	Mark1 (Used for calculation, storage and control purpose)
2	Transistor (CPU, memory, programming language and I/O units also came into the force)	None (FORTRAN , COBOL)	1956	IBM 1401, ICL 1901, B5000, MINSK-2
3	SSI and MSI (circuit based)	Yes (BASIC- Beginners All-purpose Symbolic Instruction Code)	1964	IBM S/360/370, UNIVAC 1100, HP 2100A, HP 9810
4	LSI and VLSI (micro processor based)	Yes	1971	ICL 2900, HP 9845A, VAX 11/780, ALTAIR 8800, IBM PC
5	HAL (Hardware Abstraction Layer)	Yes (Understand Natural Language)	Present and beyond	Desktops, laptops, tablets, smartphones, etc.

# FIVE GENERATIONS OF COMPUTERS



First Generation



Second Generation



Third Generation



Fourth Generation





Fifth Generation





# CLASSIFICATION OF COMPUTERS



# CLASSIFICATION OF COMPUTERS

S.No	Type	Specifications	
1	<b>Super computer</b>	<ul style="list-style-type: none"><li>● It is an extremely fast computer, most expensive.</li><li>● It Can execute hundreds of millions of instructions per second.</li><li>● Used where immense amount of mathematical calculations are there like weather forecasting Nuclear energy research Petroleum exploration</li><li>● CDC - 6600, PARAM 8000</li></ul>	
2	<b>Main Frame</b>	<ul style="list-style-type: none"><li>● It is a multi-user computer system</li><li>● Capable of supporting vast number of users simultaneously.</li><li>● Large in size, expensive</li><li>● Can process large amount of data at very high speed and support many input, output.</li></ul>	

# CLASSIFICATION OF COMPUTERS

S.No .	Type	Specifications	
3	<b>Mini Computer</b>	<ul style="list-style-type: none"> <li>It is a multi-user computer system (10 to 100)</li> <li>Smaller in size and memory capacity.</li> <li>Ex – Digital equipment corporation VAX, IBM AS/400</li> </ul>	
2	<b>Micro computers</b>	<ul style="list-style-type: none"> <li>Intended for personal need for an individual                             <ul style="list-style-type: none"> <li><b>Desktop</b></li> <li><b>Laptop</b></li> <li><b>Palmtop computer/digital diary/Notebook</b> – no separate keyboard</li> </ul> </li> </ul>	<div>   </div> <div>  </div>

# ANATOMY OF A COMPUTER

## A. HARDWARE

A.1. INPUT DEVICE

A.2. OUTPUT DEVICES

A.3. CPU

A.4. MEMORY UNIT

## B. SOFTWARE

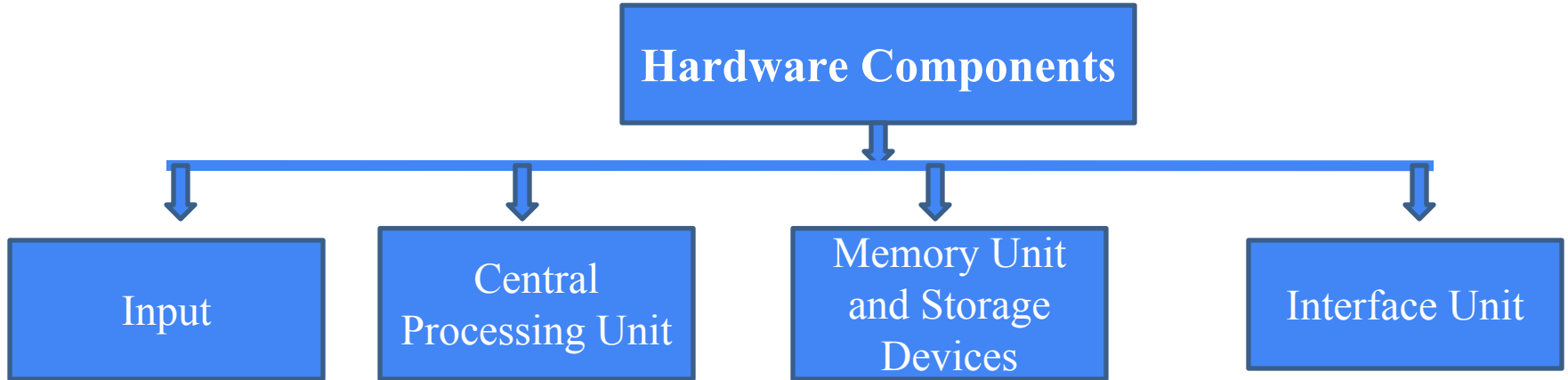
# FIVE BASIC OPERATIONS

S.No.	Operation	Description
1	Take Input	The process of entering data and instructions into the computer system.
2	Store Data	Saving data and instructions so that they are available for processing as and when required.
3	Processing Data	Performing arithmetic, and logical operations on data in order to convert them into useful information.
4	Output Information	The process of producing useful information or results for the user, such as a printed report or visual display.
5	Control the workflow	Directs the manner and sequence in which all of the above operations are performed.

# HARDWARE COMPONENTS

## Hardware :

- physical components of computer that includes all
  - Mechanical
  - Electrical
  - Electronic (Circuit Element)
  - And magnetic parts attached to it



# INPUT DEVICES

# INPUT DEVICES

- Data and instructions are typed, submitted
- They are electronic or electromechanical component
- Provides means of communicating with computer system for feeding input data and instruction.
- Most common input devices
  - **Keyboard**
  - **Mouse**
  - **Scanner**

# INPUT DEVICES - KEYBOARD

## 104 keys

- **Character keys** : Letters, numbers, punctuation marks
- **Function keys** : 12 functional keys, F1 to F12, top of keyboard. They perform different functions depending on operating system or software.
- **Control keys** : Alt, Ctrl, shift, insert, delete, home, end
- **Navigation keys**: Arrows, pg up, pg down
- **Toggle keys** : Scroll lock, Num lock, Caps lock
- **Miscellaneous key**: Insert, delete, escape, print

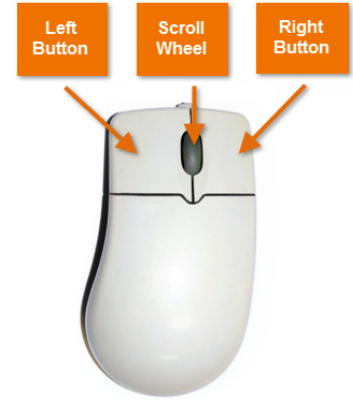
**Key Matrix** : Keys are arranged in rows and columns, When a key is pressed, that position sends a signal to the circuit board inside the keyboard, The coordinates x and y of the key is used to determine which key is pressed. Therefore the corresponding data or instruction is identified.



# INPUT DEVICES - MOUSE

## MOUSE

- It is the **pointing device**
- **Moves the cursor** around the screen and to point an object (icon, menu, command button etc)
- It has commonly 3 buttons.
- Mouse tracks the motion of the mouse pointer and senses the clicks and sends them to compute to act accordingly.
- It can connect to the system
  - Through infrared (wireless)
  - USB connector



## SCANNER

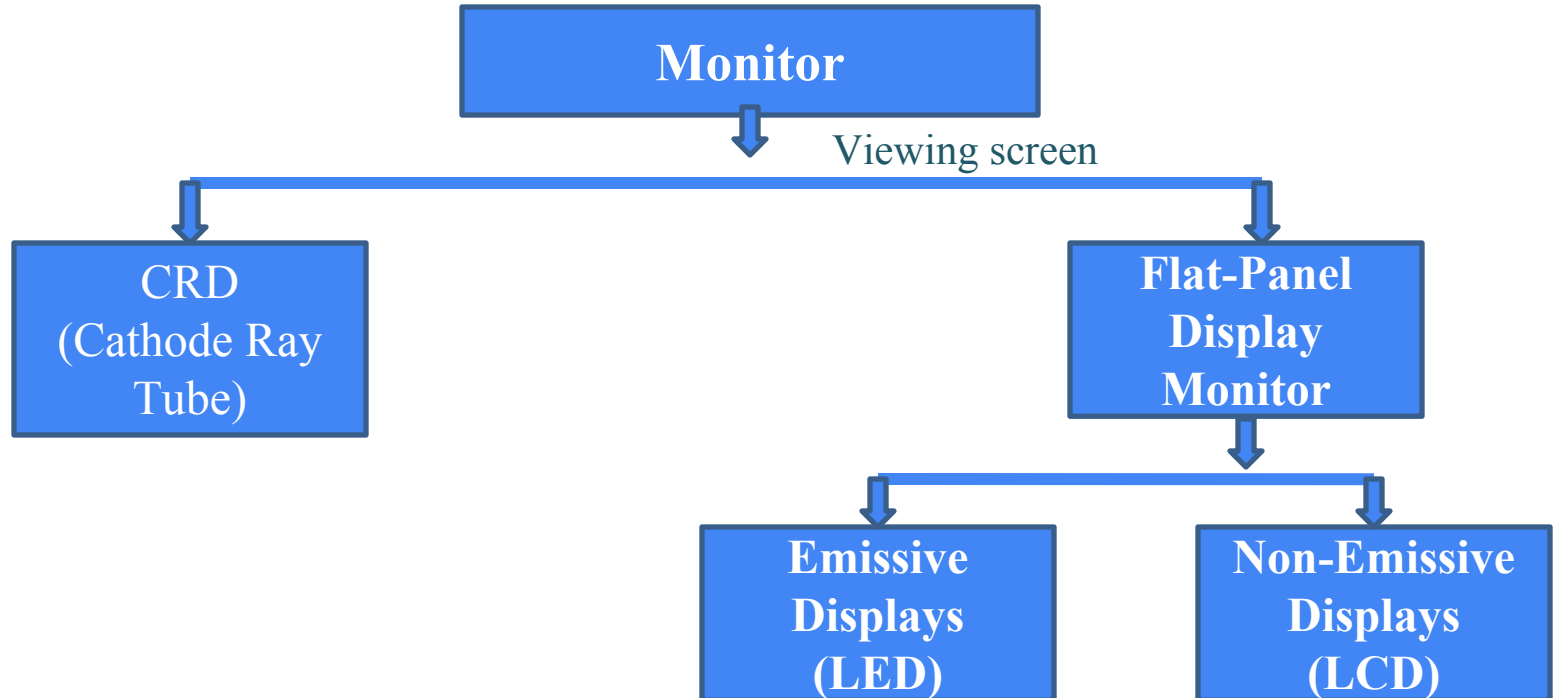
- Scans picture or document that can be stored.
- Stores in storage, can be modified suitably and transported to other computers Or can be printed on a printer



# OUTPUT DEVICES

# OUTPUT DEVICES - MONITOR

- Monitors, commonly called as **Visual Display Unit (VDU)**, are the main output device of a computer. **Flat-Panel Display Monitor**

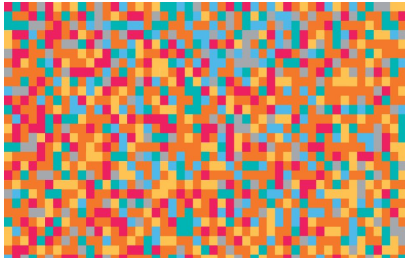


# OUTPUT DEVICES - MONITOR

## Cathode-Ray Tube (CRT) Monitor

- **The CRT display is made up of small picture elements called pixels.** The smaller the pixels, the better the image clarity or resolution. It takes more than one illuminated pixel to form a whole character, such as the letter 'e' in the word help.
- A finite number of characters can be displayed on a screen at once. The screen can be divided into a series of character boxes - **fixed location on the screen where a standard character can be placed.**
- There are some disadvantages of CRT –
  - **Large in Size**
  - **High power consumption**

**Composed of vacuum glass tube which is narrowed at one end.**



# OUTPUT DEVICES - MONITOR

## Flat-Panel Display Monitor

- **The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement in comparison to the CRT.**
- Current uses of flat-panel displays include calculators, video games, monitors, laptop computer, and graphics display.
- The flat-panel display is divided into two categories –
- **Emissive Displays** – Emissive displays are devices that **convert electrical energy into light**. For example, plasma panel and **LED (Light-Emitting Diodes)**.
- **Non-Emissive Displays** – Non-emissive displays use optical effects to convert sunlight or light from some other source into graphics patterns. For example, **LCD (Liquid-Crystal Device)**.



# OUTPUT DEVICES - PRINTER

## Printer

- Printer is an output device, which is used to print information on paper.
- Information can contain data, report, document, picture, diagrams.
- There are two types of printers –
  - Impact Printers
  - Non-Impact Printers

## Impact Printers

- Impact printers print the characters by striking them on the ribbon, which is then pressed on the paper.
- Characteristics of Impact Printers are the following –
  - Very low consumable costs
  - Very noisy
  - Useful for bulk printing due to low cost
  - There is physical contact with the paper to produce an image
  - **Example : Dot Matrix printer**

## Non-impact Printers

- Non-impact printers print the characters without using the ribbon. These printers print a complete page at a time, thus they are also called as Page Printers.
- These printers are of two types –
  - **Laser Printers** (use laser lights to produce the dots)
  - **Inkjet Printers** (spraying small drops of ink onto paper)
- Characteristics of Non-impact Printers
  - Faster than impact printers
  - They are not noisy
  - High quality
  - Supports many fonts and different character size

CENTRAL PROCESSING UNIT (CPU)



# CENTRAL PROCESSING UNIT (CPU)

**Central Processing Unit (CPU) consists of the following features**

- CPU is considered as the brain of the computer.
- CPU performs all types of data processing operations.
- It controls the operation of all parts of the computer.
- Physically it is an integrated circuit silicon chip, mounted on a small square plastic slab, surrounded by metal pins.
- Different functional units of CPU



# CENTRAL PROCESSING UNIT (CPU)

## Registers

- ❑ High speed storage devices
- ❑ Serves some special purpose , like IR – instruction register holds current instructions being executed

## Arithmetic Logic Unit (ALU)

- ❑ This unit consists of two subsections namely,
  - ❑ **Arithmetic Section** : Function of arithmetic section is to perform arithmetic operations like addition, subtraction, multiplication, and division
  - ❑ **Logic Section:** Function of logic section is to perform logic operations such as comparing, selecting, matching, and merging of data.

# CENTRAL PROCESSING UNIT (CPU)

## Control Unit

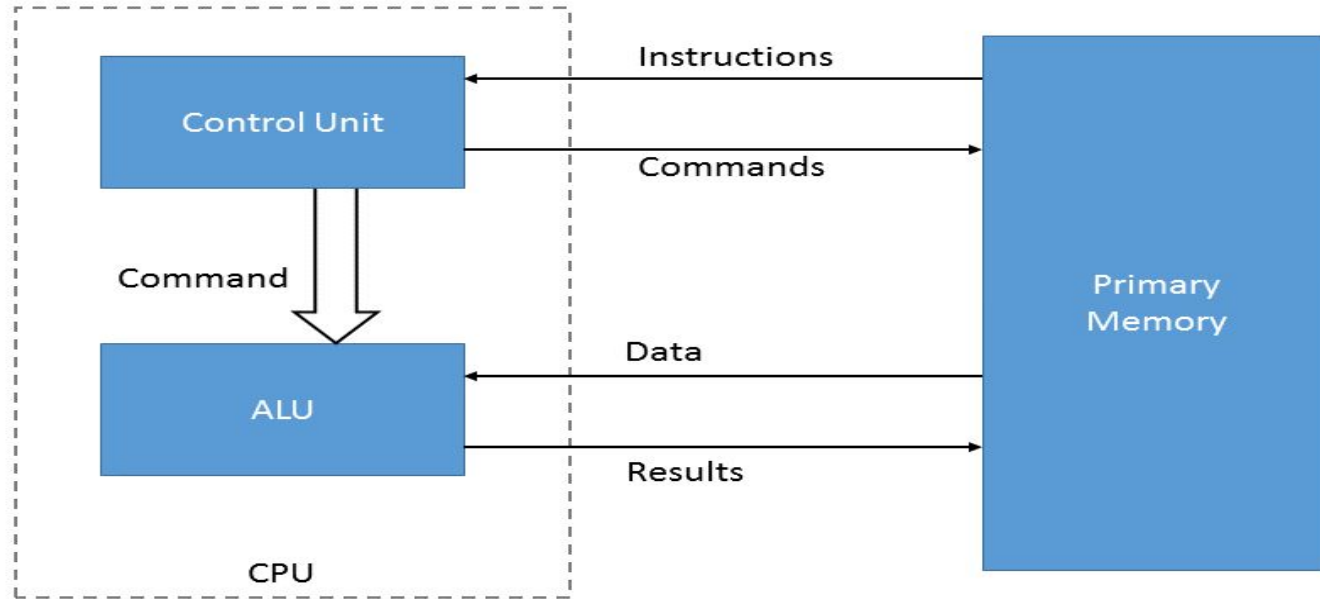
This unit controls the operations of all parts of the computer but does not carry out any actual data processing operations.

Functions of this unit are –

- It is responsible for controlling the transfer of data and instructions among other units of a computer.
- It obtains the instructions from the memory, interprets them, and directs the operation of the computer.
- It communicates with Input/Output devices for transfer of data or results from storage.
- It does not process or store data.

# CENTRAL PROCESSING UNIT (CPU)

Fetch - Decode - Execute - Store



Functions of Control Unit

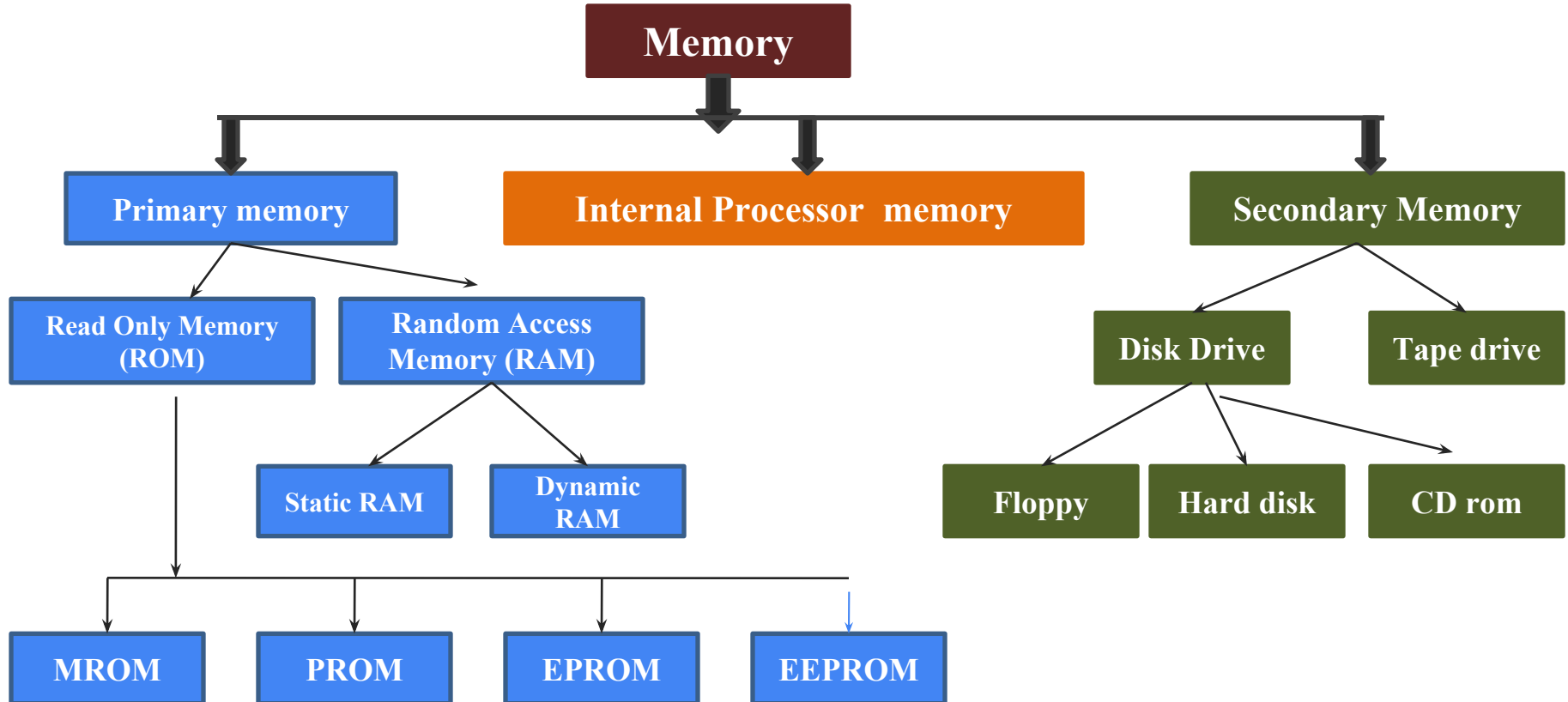
## TOPIC 3.A.4

### MEMORY UNIT

# MEMORY UNIT

- 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.

# MEMORY UNIT



## Primary (main) memory

- Primary memory holds only those data and instructions on which the computer is currently working.
- It is the working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without the primary memory.
- It is divided into two subcategories RAM and ROM.

### A. 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 (run when machine starts)**.

### **MROM (Masked ROM)**

- The very first ROMs were hard-wired devices that contained a pre-programmed set of data or instructions.



# MEMORY UNIT

	Characteristics
<b>Primary (main) memory</b>	<b>PROM (Programmable Read Only Memory)</b> <ul style="list-style-type: none"><li>PROM is read-only memory that can be modified only once by a user.</li></ul>
	<b>EPROM (Erasable and Programmable Read Only Memory)</b> <ul style="list-style-type: none"><li>EPROM can be erased by exposing it to ultra-violet light for a duration of up to 40 minutes. Data can be written electrically.</li></ul>
	<b>EEPROM (Electrically Erasable and Programmable Read Only Memory)</b> <ul style="list-style-type: none"><li>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).</li></ul>
	<b><u>B. RAM</u></b> <ul style="list-style-type: none"><li><b>RAM (Random Access Memory)</b> is the internal memory of the CPU for storing data, program, and program result.</li><li><b>It is a read/write memory</b> which stores data until the machine is working.</li><li>Holds data and instructions waiting to be processed</li><li>As soon as the machine is switched off, data is erased.</li></ul>

# MEMORY UNIT - RAM

	<u>RAM</u>	
Primary (main) memory	Static RAM (SRAM)	Dynamic RAM (DRAM)
	Memory retains its contents as long as power is being supplied.	DRAM, unlike SRAM, must be continually <b>refreshed</b> in order to maintain the data. This is done by placing the memory on a refresh circuit that rewrites the data several hundred times per second
	SRAM need not be refreshed on a regular basis. Long life.	Short life, need to be refreshed.
	Large size , expensive	Small size, less expensive
	SRAM chips use a matrix of 6-transistors and no capacitors.	All DRAMs are made up of memory cells, which are composed of one capacitor and one transistor.

# MEMORY UNIT

	RAM	ROM
<b>Definition</b>	Random Access Memory or RAM is a form of data storage that can be accessed randomly at any time, in any order and from any physical location., allowing quick access and manipulation.	Read-only memory or ROM is also a form of data storage that can not be easily altered or reprogrammed.Stores instructions that are not necessary for re-booting up to make the computer operate when it is switched off.They are hardwired.
<b>Stands for</b>	Random Access Memory	Read-only memory
<b>Use</b>	RAM allows the computer to read <a href="#">data</a> quickly to run applications. It allows reading and writing.	ROM stores the program required to initially boot the computer. It only allows reading.
<b>Volatility</b>	RAM is volatile i.e. its contents are lost when the device is powered off.	It is non-volatile i.e. its contents are retained even when the device is powered off.
<b>Types</b>	The two main types of RAM are static RAM and dynamic RAM.	The types of ROM include PROM, EPROM and EEPROM.

SOFTWARE

# SOFTWARE

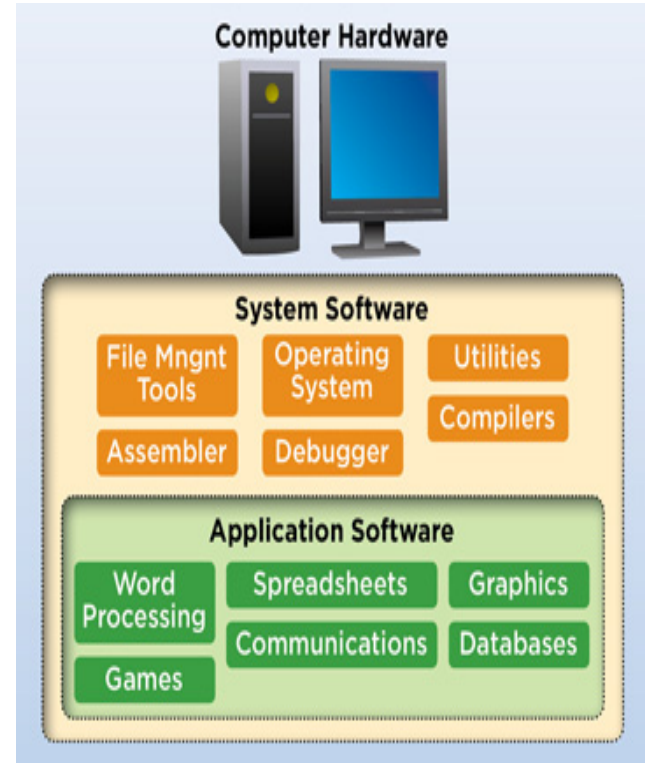
- Software is a set of programs, which is designed to perform a well-defined function. A program is a sequence of instructions written to solve a particular problem.
- There are two types of software –
- **System Software**
- **Application Software**

## System Software

- The system software is a collection of programs designed to operate, control, and extend the processing capabilities of the computer itself.
- System software is generally prepared by the computer manufacturers.
- Some examples of system software are Operating System, Compilers, Interpreter, Assemblers, etc.

## Application Software

- Application software products are designed to satisfy a particular need of a particular environment.
- Application software may consist of a single program, such as Microsoft's notepad for writing and editing a simple text. It may also consist of a collection of programs, often called a software package, which work together to accomplish a task, such as a spreadsheet package.
- Examples of Application software are the following –
- Payroll Software, Student Record Software



# UNITS OF MEMORY

- Memory unit is the amount of data that can be stored in the storage unit. This storage capacity is expressed in terms of Bytes.

S.No.	Unit & Description
1	<b>Bit (Binary Digit)</b> A binary digit is logical 0 and 1 representing a passive or an active state of a component in an electric circuit.
2	<b>Nibble</b> A group of 4 bits is called nibble.
3	<b>Byte</b> A group of 8 bits is called byte. A byte is the smallest unit, which can represent a data item or a character.

**Memory Capacity Conversion Chart**

Term (Abbreviation)	Approximate Size
Byte (B)	8 bits
Kilobyte (KB)	1024 bytes / $10^3$ bytes
Megabyte (MB)	1024 KB / $10^6$ bytes
Gigabyte (GB)	1024 MB / $10^9$ bytes
Terabyte (TB)	1024 GB / $10^{12}$ bytes
Petabyte (PB)	1024 TB / $10^{15}$ bytes
Exabyte (EB)	1024 PB / $10^{18}$ bytes
Zettabyte (ZB)	1024 EB / $10^{21}$ bytes
Yottabyte (YB)	1024 ZB / $10^{24}$ bytes

# Practical Session

## **Introduction To -**

- Linux/Unix Commands
- Gedit editor
- Compilation and Execution of a C Programme
- Some Examples

# Linux/Unix Commands

## Use of

- ls (List the files and folders)
- pwd (Print Working Directory)
- cd (Change Directory) (cd ../..)
- mkdir (Make Directory- Create new directory in the current directory)
- cp (Copy - Copy the data of one file to other file)
- mv (Move)
- rm (remove)
- rmdir (Remove Directory)



# Linux/Unix Commands

## Use of

- **mkdir**      \$ mkdir sce  
                 \$ mkdir /home/user1/kiit/setce/ece
- **cp**            \$ cp file1 file2  
                 \$ cp ak.txt bk.txt dir1 (dir1 must exist)  
                 \$ cp file1 /home/user1/kiit/scive  
                 \$ cp -r dir1 dir2 (Copies directories and subdirectories)
- **mv**            \$ mv info.txt itstudentsdata.txt (Rename)  
                 \$ mv -b info.txt itstudentsdata.txt (Rename with a Copy)  
                 \$ mv /home/user1/kiit/sce/it/first.c home/user1/kiit/sme  
                 \$ mv /home/user1/kiit/sce/it/first.c home/user1/kiit/sme/firstcprog.c (move with a new name)
- **rm**            \$ rm quard.c
- **rmdir**        \$ rmdir dir1

## gedit:

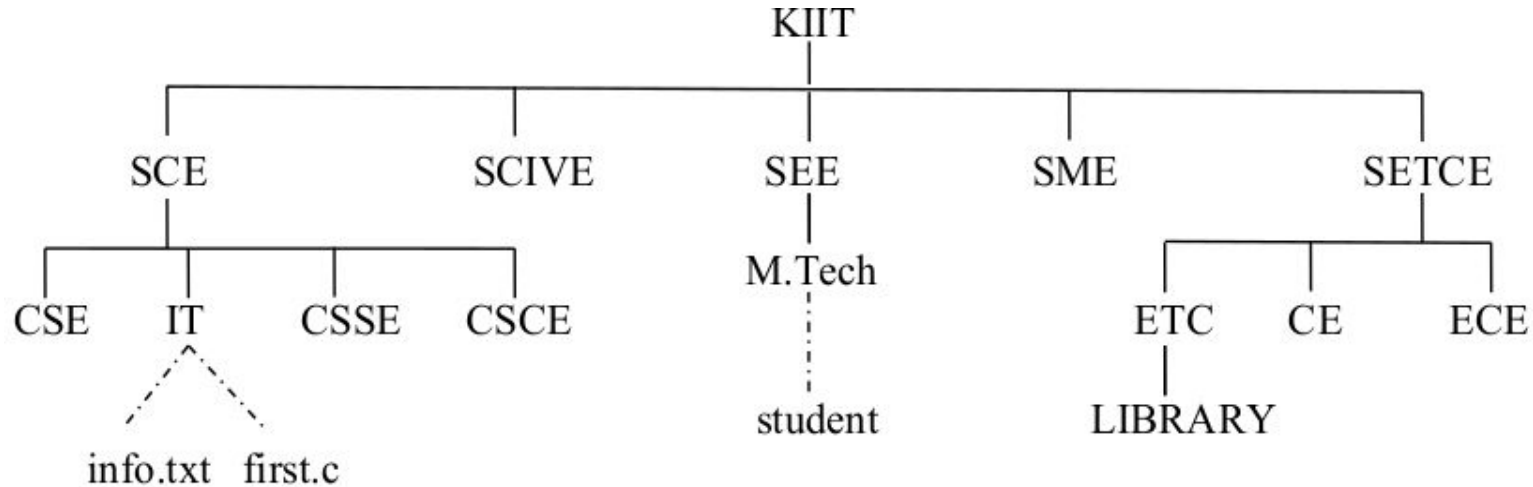
- To create a new file in c
  - `$ gedit first.c`
- To save a new file
  - File → Save
- To quit from gedit and return to command prompt
  - File → Exit
- To open an existing file
  - `$ gedit first.c`

# Compilation and Execution of a C Programme

- **Step-1:** Create a file named as first.c in gedit editor and write the a program code in it, then save the file and quit from gedit window.
- **Step-2:** Compile the C Program file named as first.c
  - \$ gcc first.c
  - \$ gcc first.c -o first
- It compiles the file sa13\_first.c, if it is error free, then go for execution to get output. Else open the file again in gedit to correct the errors, again compile it till it does not show any errors.
- **Step-3:** To get the output do the following
  - \$ ./a.out

# Some Examples

- First create a sub-directory named as your roll number under your home directory. Then create the following directory structure under your rollno directory.



Do the following operations

- Create the file names under the directories as mentioned in the figure and write some relevant data into the files.
- Rename the file info.txt as itstudentsdata.txt.
- Copy the file first.c into the directory CE with the same name.
- Transfer the file student into the directory SCIVE and check whether transferred or not.

# Some Examples

- WAP to print a message “**Welcome to C Programming Laboratory**”.

```
#include <stdio.h>
void main()
{
    printf("\n Welcome to C Programming Laboratory \n");
}
```