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COMPUTER

CHAPTER 6

Central Processing Unit

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COMPUTER · CHAPTER 6

Central Processing Unit

ਕੇਂਦਰੀ ਪ੍ਰੋਸੈਸਿੰਗ ਯੂਨਿਟ

IN THIS CHAPTER

- Functions Of Cpu
- Block Diagram Of Cpu
- Main Components Of Cpu
- Control Unit (Cu)
- Memory Trick
- Working Of Control Unit

The **Central Processing Unit (CPU)** is the most important component of a computer. It is often called the **Brain of the Computer** because it controls and performs almost all processing operations.

The CPU receives instructions from software and hardware devices, processes the data, performs calculations, and produces the desired output.

Without a CPU, a computer cannot run programs, process data, or communicate with input and output devices.

A Central Processing Unit (CPU), also known as a:

- Processor
- Central Processor
- Microprocessor



FUNCTIONS OF CPU

The CPU performs the following functions:

1. Executes Instructions: Carries out instructions given by software programs.

2. Performs Calculations:Handles arithmetic calculations such as:

- Addition
- Subtraction
- Multiplication
- Division

3. Processes Data:Converts raw data into meaningful information.

4. Controls Computer Operations:Coordinates all activities of the computer system.

5. Manages Input and Output Devices:Allows communication between:

- Keyboard and CPU
- Mouse and CPU
- CPU and Monitor
- CPU and Printer

6. Runs Software

Executes:

- Operating Systems
- Application Software
- Games
- Web Browsers

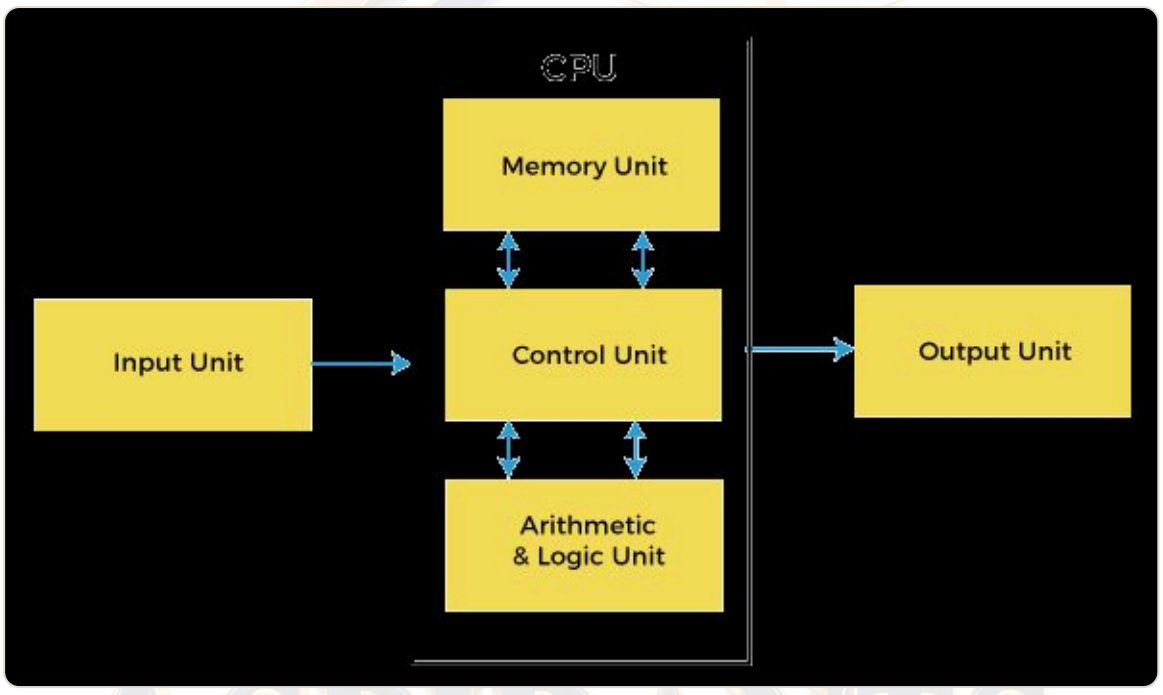
Location of CPU

The CPU is installed in a special socket called the CPU Socket,which is located on the Motherboard

Important Fact

World First Microprocessor is Intel 4004 Developed By Intel Corporation in 1971.

BLOCK DIAGRAM OF CPU



MAIN COMPONENTS OF CPU

The CPU mainly consists of:

1. Control Unit (CU)

2. Arithmetic Logic Unit (ALU)

3. Registers (Memory Unit)

1. CONTROL UNIT (CU)

The **Control Unit (CU)** is the part of the CPU that controls and coordinates all operations of the computer.

It does not process data directly but manages the activities of all other units.

The Control Unit acts like a **Traffic Police Officer** directing the flow of information inside the computer.

Functions of Control Unit

A. Controls Data Flow

Controls movement of data between:

- CPU
- Memory
- Input Devices
- Output Devices

B. Decodes Instructions

Converts instructions into understandable signals.

C. Coordinates Operations

Synchronizes activities of all hardware components.

D. Maintains Instruction Sequence

Ensures instructions are executed in the correct order.

E. Generates Control Signals

Sends signals to different parts of the CPU.

MEMORY TRICK

CU = Control Unit = Controls Everything

WORKING OF CONTROL UNIT

The Control Unit performs a cycle called:

Fetch → Decode → Execute → Store

Step 1: Fetch

The Control Unit fetches the instruction from memory.

Program Counter (PC)

The Program Counter stores the address of the next instruction.

Step 2: Decode

The fetched instruction is decoded.

Opcode:Opcode tells the CPU:"What operation must be performed?"

Operand:Operand tells the CPU:"On which data should the operation be performed?"

Step 3: Execute

The Control Unit instructs the ALU and other components to perform the required operation.

Examples:

- Addition

- Comparison
- Data Transfer

Step 4: Store

The result is stored in:

- Register
- Memory
- Output Device

Step 5: Repeat

The next instruction is fetched and the cycle continues.

2. ARITHMETIC LOGIC UNIT (ALU)

The **Arithmetic Logic Unit (ALU)** is the part of the CPU responsible for performing arithmetic and logical operations.

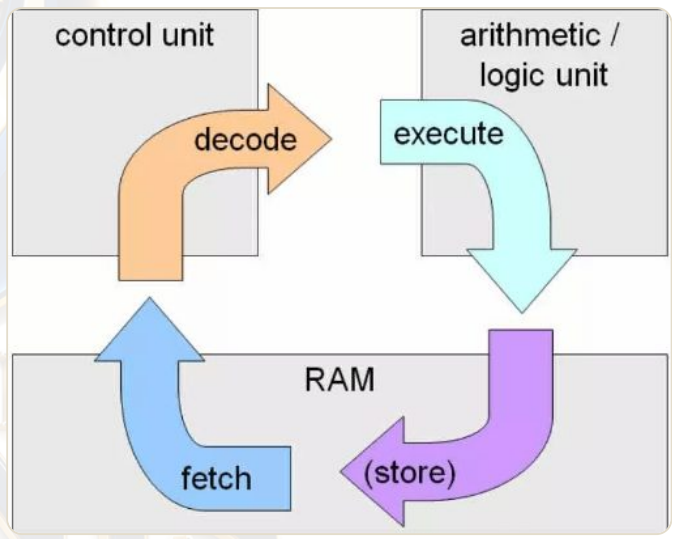
The ALU is the calculator and decision-maker of the CPU.

Functions of ALU

A. Arithmetic Operations

Performs mathematical calculations:

- Addition (+)
- Subtraction (-)
- Multiplication (×)
- Division (÷)



Example

25 + 15 = 40

ALU performs this calculation.

B. Logical Operations

Performs comparisons and decision-making operations.

Examples

- Equal To (=)
- Greater Than (>)
- Less Than (<)
- Greater Than or Equal To (≥)
- Less Than or Equal To (≤)

Example

50 > 30

ALU checks whether the statement is true or false.

CONTROL UNIT VS ALU

Feature	Control Unit (CU)	Arithmetic Logic Unit (ALU)
Function	Controls operations	Performs calculations
Data Processing	No	Yes
Decision Making	Coordinates	Performs logical decisions
Main Role	Supervisor	Calculator

REGISTERS (MEMORY UNIT)

Registers are very small and very fast memory locations inside the CPU.

Functions

- Store instructions
- Store addresses
- Store intermediate results

Examples of registers

- Program Counter (PC)
- Instruction Register (IR)
- Memory Address Register (MAR)
- Memory Data Register (MDR)

Exam Point

Registers are the **fastest memory** in a computer.

CPU CLOCK SPEED

CPU Clock Speed refers to the number of clock cycles a processor completes in one second (measured in Hz, e.g. GHz).

Unit :Hertz (Hz)

Modern CPUs are measured in Gigahertz (GHz)

UNDERSTANDING CLOCK SPEED

Example

A processor running at 4.0 GHz can perform approximately 4 Billion Clock Cycles per Second

Higher clock speed generally means better performance.

TYPES OF CPUS BASED ON NUMBER OF CORES

A core is an individual processing unit inside a CPU.

More cores allow more tasks to be processed simultaneously.

CPU Types

CPU Type	Number of Cores
Single-Core	1
Dual-Core	2
Quad-Core	4
Hexa-Core	6
Octa-Core	8
Multi-Core	More than 2

INSTRUCTION CYCLE

The Instruction Cycle is the sequence of operations performed by the CPU to execute an instruction.

It is also called Fetch-Decode-Execute Cycle

Steps of Instruction Cycle

Step 1: Fetch

The instruction is fetched from main memory.

The instruction is stored in:

CIR (Current Instruction Register)

The Program Counter is updated.

Step 2: Decode

The Instruction Decoder interprets the instruction.

Required data is fetched from memory.

Step 3: Execute

The Control Unit sends control signals.

The ALU performs the required operation.

Step 4: Store

The result is stored in:

- Memory
- Register
- Output Device

The Program Counter is updated to the next instruction.

CPU MANUFACTURERS

The two most popular CPU manufacturers are:

1. Intel

Examples:

- Intel Core i3
- Intel Core i5
- Intel Core i7
- Intel Core i9

2. AMD

Examples:

- Ryzen 3
- Ryzen 5
- Ryzen 7
- Ryzen 9

MOST IMPORTANT FACTS FOR COMPETITIVE EXAMS

- ✔ CPU is called the Brain of the Computer.
- ✔ CPU stands for Central Processing Unit.
- ✔ Intel 4004 was the first microprocessor.
- ✔ Intel 4004 was introduced in 1971.
- ✔ Control Unit controls all activities.
- ✔ ALU performs arithmetic and logical operations.
- ✔ Registers are the fastest memory.
- ✔ Clock speed is measured in GHz.
- ✔ Program Counter stores the address of the next instruction.
- ✔ Instruction Cycle = Fetch → Decode → Execute → Store.
- ✔ Intel and AMD are major CPU manufacturers.