## \*\*1. Basic Concepts\*\*

### \*\*1.1 Definition of Computer Organization\*\*

- Computer Organization refers to the way hardware components are connected and operate to form a computer system.

- It deals with the structural relationships and functional behavior of a computer system.

### \*\*1.2 Difference Between Computer Organization and Computer Architecture\*\*

- \*\*Computer Architecture:\*\* Focuses on high-level design (e.g., instruction set, memory addressing).

- \*\*Computer Organization:\*\* Deals with low-level implementation (e.g., how memory, CPU, and I/O interact).

---

## \*\*2. Functional Units of a Computer\*\*

A computer consists of five main functional units:

### \*\*2.1 Input Unit\*\*

- Accepts data/instructions from external devices (e.g., keyboard, mouse).

- Converts input into binary form for processing.

### \*\*2.2 Output Unit\*\*

- Provides results to the user (e.g., monitor, printer).

- Converts binary data into human-readable form.

### \*\*2.3 Memory Unit\*\*

- Stores data and instructions.

- \*\*Primary Memory (RAM/ROM):\*\* Fast, volatile/non-volatile.

- \*\*Secondary Memory (HDD/SSD):\*\* Permanent storage.

### \*\*2.4 Arithmetic & Logic Unit (ALU)\*\*

- Performs arithmetic (+, -, \*, /) and logical (AND, OR, NOT) operations.

### \*\*2.5 Control Unit (CU)\*\*

- Coordinates all operations by sending control signals.

- Fetches, decodes, and executes instructions.

---

## \*\*3. Von Neumann Architecture\*\*

- Proposed by John von Neumann (1945).

- Key features:

- \*\*Stored Program Concept:\*\* Instructions and data stored in memory.

- \*\*Sequential Execution:\*\* One instruction at a time.

- \*\*Components:\*\* CPU (ALU + CU), Memory, I/O.

### \*\*3.1 Limitations\*\*

- \*\*Von Neumann Bottleneck:\*\* Slow data transfer between CPU and memory.

- \*\*Sequential Processing:\*\* Limits performance.

---

## \*\*4. CPU Organization\*\*

### \*\*4.1 Registers\*\*

- Small, fast storage inside the CPU.

- Examples:

- \*\*Program Counter (PC):\*\* Holds the next instruction address.

- \*\*Instruction Register (IR):\*\* Stores the current instruction.

- \*\*Accumulator (ACC):\*\* Stores ALU results.

### \*\*4.2 Instruction Execution Cycle\*\*

1. \*\*Fetch:\*\* Get instruction from memory.

2. \*\*Decode:\*\* Determine operation.

3. \*\*Execute:\*\* Perform operation.

4. \*\*Store:\*\* Save results if needed.

---

## \*\*5. Memory Hierarchy\*\*

- \*\*Registers\*\* (Fastest, smallest) → \*\*Cache\*\* → \*\*RAM\*\* → \*\*Secondary Storage\*\* (Slowest, largest).

- \*\*Principle of Locality:\*\* Programs tend to reuse data/instructions.

---

## \*\*6. Buses in Computer System\*\*

- \*\*Data Bus:\*\* Carries data between CPU and memory.

- \*\*Address Bus:\*\* Carries memory addresses.

- \*\*Control Bus:\*\* Carries control signals (read/write).

---

## \*\*7. Performance Metrics\*\*

- \*\*Clock Speed (Hz):\*\* How many cycles per second.

- \*\*CPI (Cycles Per Instruction):\*\* Efficiency of instruction execution.

- \*\*MIPS (Million Instructions Per Second):\*\* Speed measurement.

---

## \*\*Summary\*\*

- Computer Organization deals with hardware-level design.

- Von Neumann architecture is the foundation of modern computers.

- CPU, memory, and buses are key components affecting performance.

\*\*Next Class:\*\* Instruction Set Architecture (ISA)