

# **MODULE 1**

## Fundamentals of Computer Design

# UNITS

- Unit 1: History/Evolution of Computer Technology.
- Unit 2: Computer Circuits: Integrated Circuits, VLSI Technology.

# Preamble

Hardware is the various physical components that comprise a computer system, as opposed to the non-tangible software elements. Most of these physical components are physically separated from the peripheral to the main circuitry that does the arithmetical and logical processing, but they are the most familiar bits of a computer.

# COMPUTER DEVICES(1)

- A computer consists of several interconnected devices or components. They are five basic components, namely, central processing unit, primary storage, secondary storage, input devices, and output devices. This physical equipment that make up a computer is called hardware.
- Secondary storage, input and output devices are often called peripheral equipment.
- The CPU and primary storage contain electronic circuits that store and process data or program instruction. The circuits are formed from plate of silicon which is non-metal element.
- A piece of silicon containing electronic circuits is called an integrated circuit or a chip.

# COMPUTER DEVICES(2)

- The computer chips for the CPU is called processor chips.
- In microcomputer, the entire CPU contains only one-processor chips and is called microprocessor.
- In mini computer, mainframe computer or super computer, the CPU may require several processor chips.
- Primary storage is composed of many chips for example; a microcomputer may have more than sixteen chips. Each chip is called memory chip and is capable of storing a certain amount of data.

# COMPUTER DEVICES(3)

- The amount of data stored depends on different types of chips. All the memory chips are made up primary storage (RAM).
- In microcomputers, the microprocessor and the memory chips are mounted on one board, called the Motherboard or mainboard.
- The chips in the CPU and primary storage are connected by a set of wires called a bus. Data is sent back and forth between components over the bus

# COMPUTER DEVICES(4)

- There are some other chips that are needed to control input/output devices and secondary storage. Some of these chips are built-in Mainboard or are in a separate board. They are called **add-on-boards** or **cards**, and are plugged into sockets on the mainboard.
- These **sockets which are called expansion slots** are connected to the other components by the bus.
- The combination of all these chips on or outside motherboard form computer devices

# AGENDA

- Evolution of Electronics
- Solid State Drives (SSD)
- Integrated Circuits
  - The VLSI Technology



# INTRODUCTION:

## **Evolution of Electronics.**

Electronics deals with **Circuits** which involve various **active** and **passive** Components. These Circuits are used in various Electronic Devices and are called **Electronic Circuits**.

Originally the components used in Electronic Circuits like diode were made up of vacuum tubes and were called discrete components. Later when the Solid State Device(SSD-electronic device in which electricity flows thru a semiconductor crystals ) was invented, the components were made up of semiconductors. Vacuum tubes had the disadvantage of its size, power requirement and reliability.

# INTRODUCTION(2)

- In olden days during the vacuum tube era, the size of Electronic Devices were huge, required more power, dissipated more amount of heat and were not so reliable. So there was certainly a need to reduce the size of these devices and their heat dissipation. After the invention of SSD's, the size and the heat produced by devices was undoubtedly reduced drastically, but as the days passed the requirement of additional features in Electronic Devices increased which again made the devices look bulky and complex.

# INTRODUCTION(3)

This gave birth to the invention of technology which can fabricate more number of components onto a single chip. As the need of additional features in Electronic Devices arises.

# SSD

- Solid-state [electronic](#) devices are part of our everyday lives. The **transistor**, was the first solid-state device to come into commercial use in the 1960s. Solid-state electronic devices have replaced **vacuum tubes** in just about all electronics devices. Vacuum tubes are still used in the transmitters of radio stations you listen to, many guitar amplifiers and some audiophile equipment. Vacuum tubes are the opposite of "solid-state" because tubes burnout, break, etc.

# Integrated Circuits

- Our world is full of integrated circuits. You find several of them in computers. For example, the microprocessor is an integrated circuit that processes all information in the computer. It keeps track of what keys are pressed and if the mouse has been moved. It counts numbers and runs programs, games and the operating system. Integrated circuits are also found in almost every modern electrical device such as cars, television sets, CD players, cellular phones, etc. But what is an integrated circuit and what is the history behind it?

# Integrated Circuit

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Integrated Circuit is the circuit in which all the passive and active components are fabricated onto a single chip. Initially the Integrated Chip could accommodate only a few components. As the days passed, the devices became more complex and required more number of circuits which made the devices look bulky. Instead of accommodating more circuits in the system, an **Integration technology** was developed to increase the number of components that are to be placed on a single chip. This Technology not only helped to reduce the size of the devices but also improved their speed. Depending upon the number of components (Transistors) to be integrated, they were categorized as SSI, MSI, LSI, VLSI, ULSI & GSI.

# Transistor vs Vacuum Tube

- Of the components of ICs, the transistor is the most important one for the development of modern computers. Before the transistor, engineers had to use vacuum tubes. Just as the transistor, the vacuum tube can switch electricity on or off, or amplify a current. So why was the vacuum tube replaced by the transistor? There are several reasons.
- The vacuum tube looks and behaves very much like a light bulb; it generates a lot of heat and has a tendency to burn out. Also, compared to the transistor it is slow, big and bulky.

Types of lcs....



# SSI

The first ICs contained only a few transistors and so were called “Small-Scale Integration (SSI).

In this Technology, 1-100 Transistors were fabricated on a single chip. E.g Gates , Flipflops They used circuits containing transistors numbering in the tens. They were very crucial in development of early computers. SSI was followed by introduction of the devices which contained hundreds of transistors on each chip, and so were called “Medium-Scale Integration (MSI).

# MSI

Introduced after SSI. Using this Technology, 100-1000 number of Transistors could be integrated on a single chip.i.e. it contains hundreds of transistors on each chip.

MSI were attractive economically because they cost little more systems to be produced using smaller circuit boards, less assembly work, and a number of other advantages. Next development was of Large Scale Integration (LSI).

# LSI

In this Technology, 1000-10000 Transistors could be integrated on a single chip e.g. 8 bit Microprocessors The development of LSI was driven by economic factors and each chip comprised tens of thousands of transistors. It was in 1970s, when LSI started getting manufactured in huge quantities. LSI was followed by Very Large Scale Integration (VLSI).

# VLSI

In this Technology, 10000-1 Million Transistors could be accommodated, e.g 16-32 bit Microprocessors. This is where hundreds of thousands of transistors were used and still being developed. It was for the first time that a CPU was fabricated on a single integrated circuit, to create a microprocessor.

VLSI has reduced the size of the electronic circuits, made the electronic circuits faster and more reliable..

1. What is the necessity for fabricating many of Transistors on a single chip?
2. Enumerates and briefly explain the advantages of VLSI

**ASSIGNMENT :**