UNIT 4 INSIDE SYSTEM UNIT

After the completion of Unit - 4, the Students will be able to:

- differentiate between CPU and system unit.
- identify computer casing and its types.
- explore the system unit:
  - Power Supply
  - Motherboard with its various parts
- describe the ports (Serial, Parallel, PS/2, USB and Fire wire).
- identify expansion cards (sound, Video, Modem and Network).
- describe memory chips (SIMM, DIMM, SDRAM and DDR).

4.1 COMPUTER CASING/SYSTEM UNIT

It is a rectangular box (casing) with many components that make the entire computer system. System unit components include the motherboard, processor, expansion cards, expansion slots, power supply, disk drives, memory modules, ports, and connectors. The motherboard is the main part of the system unit which contains many different types of chips, or small pieces of semi-conducting material, on which one or more integrated circuits (IC) are etched. System units are available in different shapes and sizes.

4.1.1 CPU and System unit

Sometimes people erroneously refer the system unit as CPU but these are two different things. A computer **System unit** is the case with the motherboard and all the other parts while **CPU** is the Central Processing Unit, a chip on the motherboard that does all the processing.

The CPU chip is installed in a slot on motherboard which is placed inside the casing of the system unit.

Figure 4.1 CPU

Figure 4.2 System Unit with other important components

4.1.2 Computer Casings

A computer case also known as computer chassis, cabinet, box, tower, enclosure, housing, system unit or simply case is the enclosure that contains most of the components of computer system. Cases are usually constructed from steel or aluminum. Plastic and other materials such as wood or Lego are also used.

Types of Computer Casings

There are two common types of Computer casings.

a. Desktop Casing
b. Tower Casing

a. Desktop Casing

Desktop casing is the old type of casing which is designed to keep on the desk and usually monitor is placed over it. Figure 4.3 a.

b. Tower Casing

Tower casing is the modern type of casing which is more attractive and common. Monitor is kept side by side with the tower casing. Figure 4.3 b.

Figure 4.3 a. Desktop Casing

Figure 4.3 b. Tower Casing

4.1.3 Exploring the System Unit

System unit contains the following two main parts.

a. Power Supply
b. Motherboard

a. Power Supply

A power supply unit is the component that supplies power to the other components of a computer system. Power supply changes alternating current (AC) to low-voltage direct current (DC) to operate the processor and peripheral devices. Several direct-current voltages are required, and they must be regulated with some accuracy to provide stable operation of the computer. Computer power supplies may have short circuit protection, overpower (overload) protection, over voltage protection, under voltage protection, over current protection, and over temperature protection. Today most power supplies follow Advance Technology Extended (ATX) standard.

Figure 4.4 Power Supply

b. Motherboard

Motherboard is the main circuit board in computer system that hold main component of the system unit. It is mounted inside the casing. It is securely attached via small screws through pre-drilled holes. Several different types of chips (e.g., CPU and memory chips) can be found on the motherboard. The motherboard also contains expansion slots into which other circuit boards can be inserted for the expansion of the computer system. Other devices such as hard disk, sound, video controller and peripheral devices may be connected to motherboard through plug-in cards or via cables. Modern computers integrate these peripheral into motherboard. Most modern motherboard may include the following:

- One or more slots for CPU
- Slots for main memory
- Integrated Graphics Cards
- PCI Slots
- PCI Express Slots
- IDE Connector (for Hard Disk, CD Drive)
- SATA Connector
- Connecters for peripheral devices (mouse, keyboard, speaker, Mic etc)

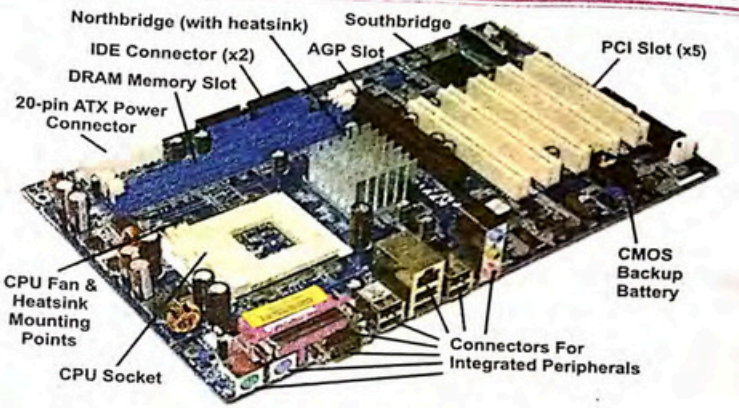

Figure 4.5 A Motherboard

Some important components on motherboard

1. Basic Input Output System (BIOS)

Basic Input Output System (BIOS) also known as the System BIOS or simply BIOS is the firmware built into the computer system. Firmware is a fixed, usually small program that controls various electronic devices. BIOS is the first program run by a computer when it is powered on. The main function of the BIOS is to load and start an operating system (OS). The first job of BIOS is to check and initialize system devices such as the video card, keyboard, mouse, hard disk and other hardware. BIOS then locates OS on hard disk or CD or flash memory drive. After loading and executing the OS, BIOS gives control to the system. This process is called booting or booting up the system.

Using BIOS a user can:

- Configure hardware
- Set the system clock
- Enable or disable system components
- Select bootable device sequence
- Set password for system and user login

Many PC manufacturers today use flash-memory cards to hold BIOS information. This allows users to update the BIOS version on computers after a vendor releases an update. This system was designed to solve problems with the original BIOS or to add new functionality.

2. Ports

In computer hardware, a port connects peripheral devices to the computer system. A port is a piece of equipment to which a plug or cable is connected. Common computer ports include:

- Serial Ports
- Parallel Port
- PS/2 Mouse Port
- PS/2 Keyboard Port
- VGA Port
- USB (Universal Serial Bus)
- Ethernet LAN Port
- Audio Ports

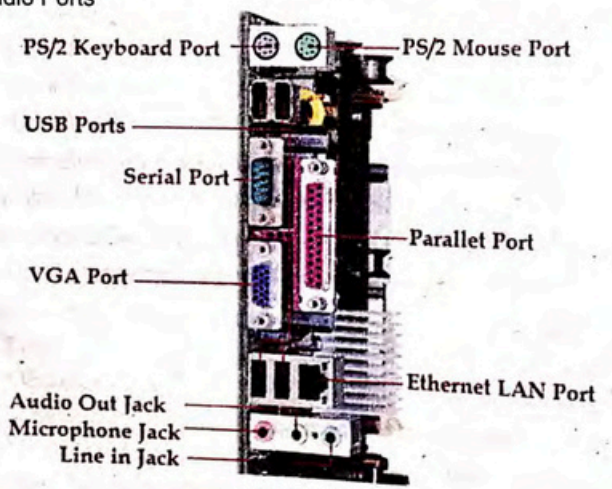

Figure 4.6 Ports

3. Expansion Slots

These are openings or sockets in a computer motherboard where a circuit board or expansion card can be inserted to add new functionalities to the computer. Nearly all computers contain expansion slots. The devices inserted into the expansion slots are called expansion boards, cards, add-ins or add-ons. The common standard of expansion slots includes AGP, PCI and PCI Express.

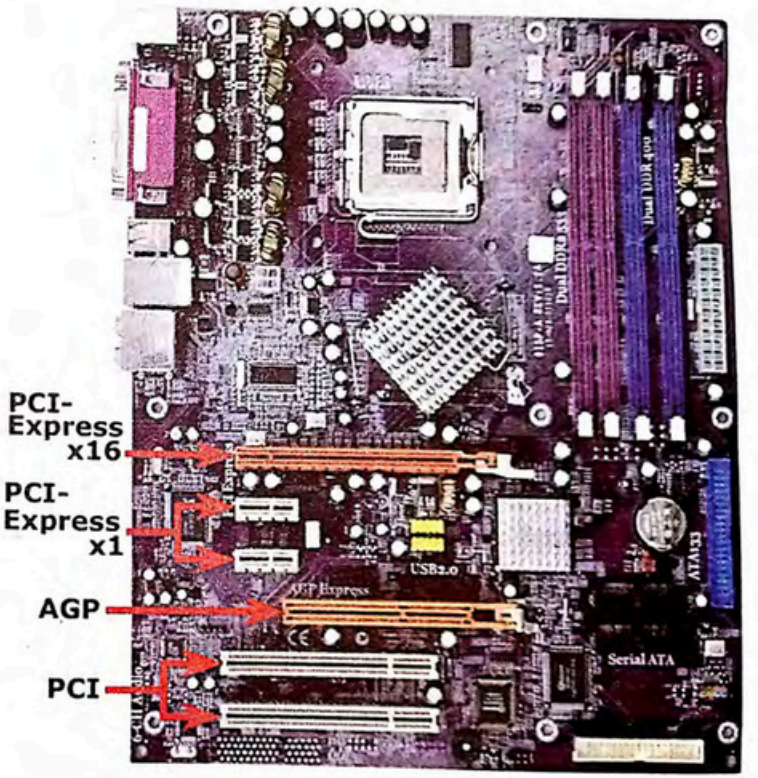

Figure 4.7 Expansion Slots

i. Accelerated Graphics Port (AGP)

The Accelerated Graphics Port (AGP) is a high-speed point-to-point channel (pathway), primarily used for 3D computer graphics. The AGP enable computer to have a dedicated way to communicate with the graphics card, as compared to Peripheral Component Interconnect (PCI). The main advantage of AGP over PCI is that it provides dedicated pathway between the slot and the processor while PCI bandwidth is shared by various devices.

ii. Peripheral Component Interconnect (PCI)

The Peripheral Component Interconnect (PCI) is a computer bus (an electric pathway) for attaching hardware device in a computer. These devices can be Integrated Circuits (ICs) fitted onto the main board or an expansion card that fits into a slot. Typically PCI cards used in computers include networks cards, sound cards, MODEM, extra ports such USB or serial, TV tuner cards and disk controllers. PCI is still used in some computers but is superseded by PCI Express.

iii. PCI Express Slot

Peripheral Component Interconnect Express (PCI Express), abbreviated as PCIe, is a computer card expansion standard developed by Intel, Dell, IBM and HP in 2004 to replace older PCI and AGP standards. PCIe preserves compatibility with PCI. PCIe has many improvements over conventional PCI, which includes more bandwidth (6400MB/s whereas PCI has 133MB/s and AGP has 2100MB/s), maximum system bus throughput, good error detection and reporting mechanism and hot plugging. It is the latest standard expansion slot used in micro and laptop computers. PCIe also supports latest sound cards, TV tuner cards, Fire-wire cards, etc.

4. Ribbon Cable

A ribbon cable also known as multi-wire planar cable is a cable with many conducting wires running parallel to each other on the same flat plane. As a result the cable is wide and flat as ribbon. Ribbon cables are usually used for internal peripheral of computer, such as hard drives, CD drives and floppy drives.

The following are the main types of ribbon cables.

a. **IDE Cable**
b. **SATA Cable**
c. **FD Cable**

i. IDE Cable

IDE short for Integrated Drive Electronics is more commonly known as ATA/ATAPI (Advance Technology Attachment/ ATA Packet Interface) or PATA (Parallel ATA) is a ribbon cable standard used for connecting hard drives developed by Western Digital. Original IDE was designed only for hard drives. ATAPI a new version was developed to connect CD-ROM, tapes drives and Zip drive. IDE has largely been replaced by Serial ATA (SATA) in newer systems.

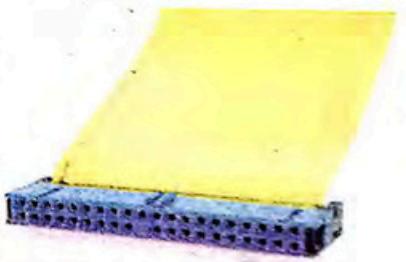

Figure 4.8 IDE Cable

ii. SATA Cable

SATA (Serial Advanced Technology Attachment) is a new technology cable for connecting storage drives to computer. It was designed to replace IDE bus interface. SATA bus interface is used in all the modern laptop and desktop computers. SATA drives communicate with high speed. These cables transfer data at high rates (from 1.5 to 6 gigabytes per second). SATA1, SATA2 and SATA3 interfaces provide communications at rates of 1.5 GB/Sec, 3 GB/Sec and 6 GB/Sec respectively.

Figure 4.9 SATA Cables

iii. FD Cable

FD (Floppy Disk) cable was used in the past to connect floppy drives to the motherboard. Floppy drives are almost obsolete nowadays. Due to this reason FD cable is no more used with modern microcomputers.

Figure 4.10 FD Cable

5. Memory Slots

A computer memory slot is a socket or opening in computer main board in which the main memory is installed. The number and type of memory slots varies from motherboard to motherboard, but at least two slots are available on every motherboard.

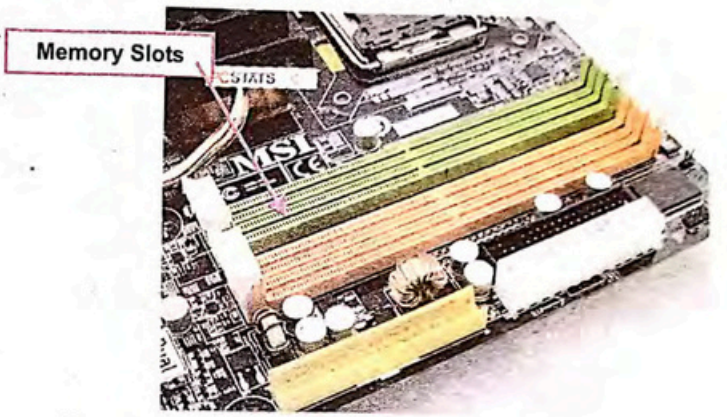

Figure 4.11 Memory Slots

6. Disk Controller

Disk controller is the circuit which enables the CPU to communicate with disk drives like hard disk and compact disk. Old disk controllers were implemented on a separate controller card. Modern disk controllers are integrated into the disk drive itself. For example, EIDE and SATA hard drives have their disk controller circuit inside the drives.

7. Cooling System

Cooling system is used to maintain proper temperature inside the system unit. Various hardware such as CPU, video card or even the hard drive generate heat inside the system unit. The objective of cooling is to maintain an optimal operating temperature and this can be achieved through the introduction of

heat sinks and fans. If the temperature inside the system unit reaches a certain point, it can damage the parts. A fan is fixed on top of the microprocessor to cool it down. Heat sinks are also used to dissipate heat from the surface area of the motherboard. Many computers are designed to turn themselves off if the temperature exceeds certain level.

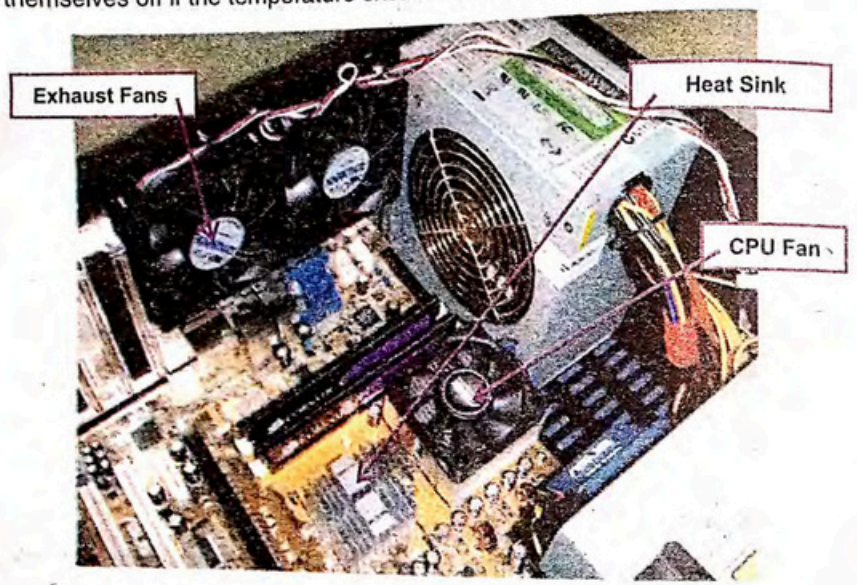

Figure 4.12 Cooling System

8. Computer Bus

Computer Bus is an electrical pathway or channel though which the processor communicates with internal and external device attached to the computer. Bus transfers data and instruction from and to processor from various devices. It connects all internal components to the main memory and Central Processing Unit (CPU). The size of the computer bus is important because it determines that how much data can be transferred at a time. Its speed is measured in the MHz and GHz.

The three types of computer buses are:

Data bus connects the CPU, memory and the other hardware devices on the motherboard.

Address bus connects the CPU and RAM.

Control bus is used to send control signals to different components of the computer system.

4.2 PORTS AND SLOTS ON MOTHERBOARD

Slots and Ports are physical connection points on the motherboard that allow the hardware of a computer to be expanded. A **Port** is a socket while a **Slot** is an opening for circuit boards.

4.2.1 Types of Ports

Ports are connectors used to connect external cables and devices to the motherboard. The following are some common types of ports.

a. **Serial Ports**
b. **Parallel Ports**
c. **PS/2 Port**
d. **USB Port**
e. **Fire Wire Port**

a. Serial Ports

A serial port is a serial communication physical interface through which information transfers in or out one bit at a time. These ports were used in old types of computers to connect devices like modems. Serial ports have 9 or 25 pins in which one pin is used for transmitting data and the rest are used to transmit control signals. These ports are called COM1, COM2 and COM3. These ports have been replaced with USB ports in modern computers.

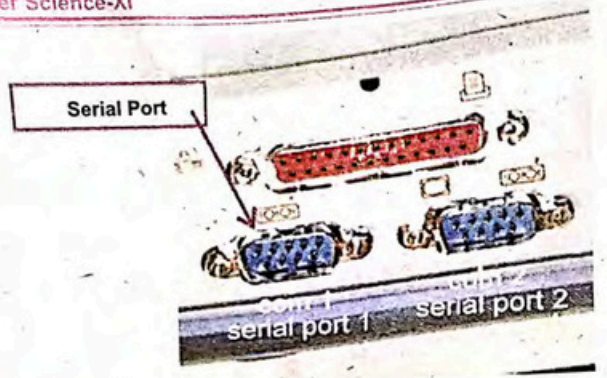

Figure 4.13 Serial Ports

b. Parallel Ports

A parallel port is a parallel communication physical interface. It is also known as a printer port. Parallel ports can transmit multiple bits over several wires at a time. These ports have 25 pins in which 8 pins transmit one byte of information and the others are used for transmitting control signals. Parallel ports are named as LPT1, LPT2 and LPT3. In today's modern computers parallel ports have been replaced with USB ports.

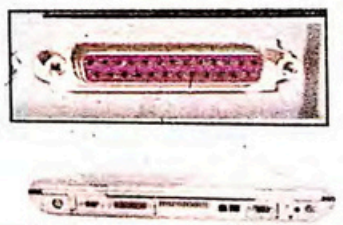

Figure 4.14 Parallel Port

c. PS/2 Port

The PS/2 connectors are used for connecting keyboard and mouse to a IBM compatible personal computer. Its name comes from the IBM Personal System/s series of personal computers which were introduced in 1987. The PS/2 mouse connector replaced the older serial mouse connector, while PS/2

keyboard connector replaced the larger keyboard connector used in the IBM PC/AT design.

The purple PS/2 connector is used for keyboard and green is used for mouse.

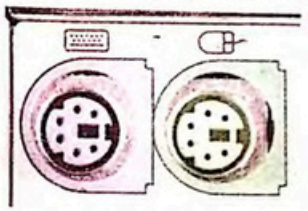

Figure 4.15 PS/2 Ports

d. USB Port

USB (Universal Serial Bus) is a serial port which provides a fast serial transmission between devices and computers. It is the most commonly used port in modern computers for connecting a large variety of devices to the computer such as printers, scanners, cameras, mouse, keyboard and USB flash drives. A computer has many USB ports and these are plug-and-play ports. Plug-and-play ports automatically detect and determine what type of device is attached to the computer. When a computer detects a plug-and-play device it automatically installs the driver for it or prompts the user to install it. USB has replaced old serial and parallel ports in computer systems.

Figure 4.16 USB Port

e. Fire wire Port

Fire wire is a high speed port which is used to connect video devices such as video Cameras, Camcorders, etc. to the computer system. Fire wire port has four or six pins. In a six pin connection, 2 extra pins are used to provide

electric power. Laptop computers have 4-pin fire wire port because they do not provide electric power to devices connected to it.

Figure 4.17 Fire wire Ports

4.2.2 Types of Expansion Cards

Expansion cards are circuit boards which are inserted into expansion slots on the motherboard. These cards provide new enhancements to the computer system such as sound, video, Internet access and network access.

Four common types of expansion cards are:

a. Sound Card
b. Video Card
c. Modem Card
d. Network Interface Card

a. Sound Card

Sound card also known as an audio card is an internal expansion card that facilitates the input and output of audio signals to and from a computer. A sound card plays voice as well as music files, and can handle various audio file formats. The typical sound card has an interface available at the back of the computer with various input and output ports.

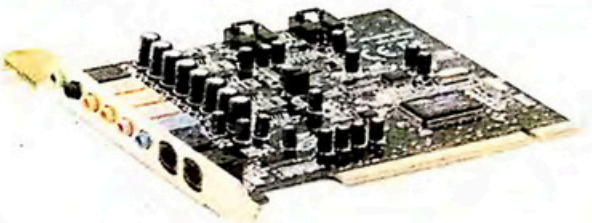

Figure 4.18 Sound Card

b. Video Card

A video card also known as video adapter, graphics accelerator card, display card or graphics card is an expansion card whose function is to generate output images to a display unit. Some cards contain dual GPUs for additional performance. Because graphics cards work hard they generate heat. For this reason most high-performance video cards utilize built-in fans or heat sinks to pull heat away from the GPU.

Figure 4.19 Video Card

c. Modem Card

The term modem is derived from modulator and demodulator. The main purpose of modem is to convert digital data into analog signals before sending it over the transmission line and convert it to digital signal on the receiving computer.

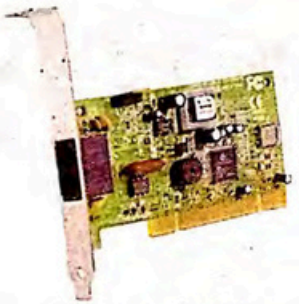

Figure 4.20 MODEM Card

d. Network Interface Card (NIC)

A network interface card also known as network interface controller, network adapter and LAN adapter is computer hardware component that connect a computer to a computer network. Usually NIC is installed as expansion card in the expansion slot, but most modern computers have built-in network interface cards on the motherboard.

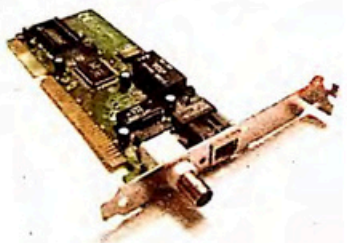

Figure 4.21 NIC

4.2.3 Memory Chips

Memory chips are integrated circuits that can either temporarily or permanently store data and code for processing. RAM chips (SIMM, DIMM, SDRAM, and DDR-SDRAM) are the computer's temporary workspace, while flash memory chips are permanent. ROM and PROM chips can never be changed, while EPROMs and EEPROMs can be modified.

The following are some common types of memory chips.

a. Single In-line Memory Module (SIMM)

A SIMM or single in-line memory module is type of RAM used in the computers from the early 1980s to the late 1990s. SIMMs were introduced in two flavors, 30 pin and 72 pin. 30-pin SIMMs provides 9 bits of data and was used in 286, 386, 486 models of computers and in some Macintosh models. The second variant, 72 pins SIMMs provides 32 bits of data and was used in 486, Pentium, Pentium Pro and even some Pentium II systems. SIMMs had storage capacity ranging from 56KB to 32MB.

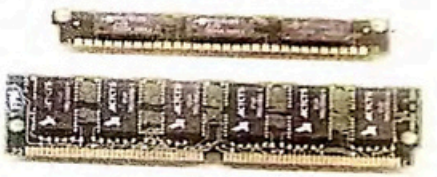

Figure 4.22 SIMMS

b. Dual In-line Memory Module (DIMM)

DIMM (Dual in-line memory module) resides on a computer's motherboard. It is the upgraded form of SIMM. It has more storage capacity and operates at faster speeds than SIMM. One DIMM module can do the job of two SIMM modules. A DIMM memory module has a 168-pin connector and can transfer data at a rate of 64 bits.

DIMM memory modules allow multiple lines of communication within a computer. DIMM connectors link up to different circuits as opposed to a SIMM, which can only produce a single line of communication. Capacities of DIMMs range from 64MB to 512MB.

Figure 4.23 A DIMM

c. Synchronous Dynamic Random Access Memory (SDRAM)

SDRAM also known as single data rate (SDR) SDRAM, is dynamic random access memory (DRAM). SDRAM is a high speed semiconductor memory. It is an improved form of the older DRAM (Dynamic Random Access Memory). SDRAM operates synchronously, which means that it operates in sync with the system data bus. Therefore, it can operate at much greater speeds than non-synchronous RAM. SDRAM transmits data at the same clock speed as the CPU's internal clock, allowing for faster and more efficient data transfer. SDRAM is commonly used in modern computers and new generations like DDR (also known as DDR1), DDR2 and DDR3 are available in the market.

Figure 4.24 SDRAM

d. Double Data Rate Synchronous Random Access Memory (DDR SDRAM)

DDR SDRAM is type of SDRAM. The name "double data rate" refers to the fact that a DDR SDRAM can achieves nearly twice the bandwidth of a single data rate (SDR) SDRAM running at the same speed. It is improved SDRAM which allows a computer to transfer data at twice the speed. It has improved memory clock speed as compared to simple SDRAM. It reads or writes two consecutive words per clock cycle.

Figure 4.25 DDR SDRAM

SUMMARY

- The System Unit is core of a computer system. Usually it is a rectangular box with many electronic components that make the entire system.
- A computer case also known as computer chassis, cabinet, box, tower, enclosure, housing, system unit or simply case is the enclosure that contains most of the components of computer system.
- A power supply unit is the component that supplies power to the other components of a computer system.
- Motherboard is the main circuit board in computer system that hold main component of the system unit.
- Basic Input Output System (BIOS) also known as the System BIOS or simply BIOS is the firmware built into the computer system.
- A port is a piece of equipment to which a plug or cable is connected.
- Expansion slot is an opening or socket in a computer mainboard where a circuit board or expansion card can be inserted to add new functionalities to the computer.
- The Accelerated Graphics Port (AGP) is a high-speed point-to-point channel (pathway), primarily used for 3D computer graphics.
- The Peripheral Component Interconnect (PCI) is a computer bus (an electric pathway) for attaching hardware device in a computer.
- A ribbon cable also known as multi-wire planar cable is a cable with many conducting wires running parallel to each other on the same flat plane.

- SATA (Serial Advanced Technology Attachment) is a new technology cable for connecting storage drives to computer.
- A computer memory slot is a socket or opening in computer main board in which the main memory chip is installed.
- Disk controller is the circuit which enables the CPU to communicate with disk drives.
- Cooling system is used to maintain proper temperature inside the system unit.
- Computer Bus is an electrical pathway or channel through which the processor communicates with internal and external devices attached to the computer.
- A serial port is a serial communication interface through which information transfers in or out one bit at a time.
- A parallel port is a parallel communication interface.
- USB (Universal Serial Bus) is a serial port which provides a fast serial transmission between devices and computers.
- Fire wire is a high speed port which is used to connect video devices such as video Cameras, Camcorders. to the computer system.
- Sound card also known as an audio card, is an internal expansion card that facilitates the input and output of audio signals to and from a computer.

- A video card also known as video adapter, graphics accelerator card, display card or graphics card is an expansion card whose function is to generate output images to a display unit.
- A network interface card also known as network interface controller, network adapter and LAN adapter is computer hardware component that connect a computer to a computer network.
- Memory chips are integrated circuits that can either temporarily or permanently store data and code for processing.
- A SIMM or single in-line memory module is type of RAM.
- DIMM (Dual in-line memory module) is the upgraded form of SIMM.
- SDRAM (Single Data rate RAM) is a high speed semiconductor memory.
- DDR SDRAM (Double Data rate SDRAM) is twice the bandwidth of a single data rate (SDR) SDRAM.

EXERCISE

Q1. Select the best choice for the following MCQs.

i. _____ changes alternating current (AC) to low-voltage direct current (DC) to operate the processor and peripheral devices.
A. Motherboard
B. Power Supply
C. Output Unit
D. Register

ii. Which of the following is the firmware built into the computer system?
A. Slot
B. RAM
C. Port
D. BIOS

iii. _____ are openings or sockets in a computer motherboard where a circuit board or expansion card can be inserted to add new functionalities to the computer.
A. BIOS
B. Ports
C. Power Supplies
D. Expansion Slots

iv. Which of the following port is a high-speed point-to-point channel (pathway), primarily used for 3D computer graphics?
A. AGP
B. PCI
C. PCIe
D. ISA

v. _____ is a new technology cable for connecting storage drives to computer.
A. IDE
B. PCIe
C. FD
D. SATA

vi. Which of the following is the fastest slot?
A. AGP
B. PCI
C. PCIe
D. ISA

vii. _____ is the circuit which enables the CPU to communicate with disk drives.
A. Memory
B. Disk controller
C. Bus
D. Port

viii. _____ is the most commonly used port in modern computers for connecting a large variety of devices to the computer.
A. USB
B. PS/2
C. Fire wire
D. LPT1

ix. Which of the following cards facilitates the input and output of audio signals to and from a computer?
A. Video Card
B. Modem Card
C. Sound card
D. Network Interface Card

x. What does SIMM stand for?
A. System in-line memory module
B. Synchronous in-line memory module
C. Single in-line memory module
D. Serial in-line memory module

Q2. Give short answers to the following questions.

i. Differentiate between CPU and System unit.
ii. Define two main types of computer casings.
iii. List different parts of a motherboard.
iv. What is role of BIOS in computer system?
v. Differentiate between a port and a slot.
vi. Name different types of data cables with their purpose of use.
vii. Why cooling system is important for a computer?
viii. Differentiate between SIMM and DIMM.