FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
NIGER STATE, NIGERIA

CENTRE FOR OPEN DISTANCE AND e-LEARNING (CODeL)

B.TECH. COMPUTER SCIENCE PROGRAMME

COURSE TITLE

HARDWARE SYSTEM AND MAINTENANCE

COURSE CODE
CPT 226

COURSE CODE
CPT 226

COURSE UNIT
1

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CPT 226 Study Guide

Introduction

CPT 226 Hardware System and Maintenance is a 1 credit unit course for students studying towards acquiring a Bachelor of Science in any field. The course is divided into 3 modules and 4 study units. It will first take a brief review of computer systems parts and their various functions. Next, the maintenance techniques approaches and tools, diagnostics techniques, system assembly and installations are carefully treated. Thereafter, the different methods of troubleshooting and repair of computer systems and accessories, which will enable the reader, have proper understanding of Computer hardware and system maintenance, are treated in detail.

The course guide therefore gives you an overview of what CPT 226 is all about, the textbooks and other materials to be referenced, what you expect to know in each unit, and how to work through the course material.

Recommended Study Time

This course is a 1-credit unit course having 4 study units. You are therefore enjoined to spend at least 1 hours in studying the content of each study unit.

What You Are About to Learn in This Course

The overall aim of this course, CPT 226 is to introduce you to computer hardware and its parts, their functions and how to detect problems. At the end of this course you will:

i. Know the basics of computer hardware and its parts
ii. Know the functions of various parts of the computer hardware
iii. Know basic maintenance techniques
iv. Be able to detect faults in computer hardware
v. Know the major roles of computer hardware in computer science

Course Aims

Hardware system and maintenance is designed for people who want a thorough understanding of PC hardware and how their PC systems work. Each section fully explains common and not-so-common problems, what causes the problems, and how to handle problems when they arise.

Course Objectives

It is important to note that each unit has specific objectives. Students should study them carefully before proceeding to subsequent units. Therefore, it may be useful to refer to these objectives in the course of your study of the unit to assess your progress.

You should always look at the unit objectives after completing a unit. In this way, you can be sure that you have done what is required of you by the end of the unit.

However, below are overall objectives of this course. On completing this course, you should be able to:

(i). Get a simple idea of how a computer system works
(ii). Define the hardware
(iii). Give a brief explanation of basic hardware components.
(iv). Know your input and output devices and how they differ
(v). Understand the various types of software
(vi). Know an overbuild a computer system
(vii). Identify the major components needed to build the computer system
(viii). Explore how to choose between the different makes and models of different hardware components
(ix). Install software and test the completed system
(x). Know the purpose of software updates
(xi). Know the process needed to perform updates

Working Through This Course

To complete this course, you are required to study all the units, the recommended text books, and other relevant materials. Each unit contains some self-assessment exercises and tutor assignments, and at some point in these courses, you required to submit the tutor marked assignments. There is also final examination at the end of these courses. Stated below are the component of these courses and what you have to do.

Course Materials

The major components of the course are:

1. Course Guide
2. Study Units
3. Text Books
4. Assignment File
5. Presentation Schedule

Study Units

There are 4 study units and 3 Modules in this course. They are:

MODULE 1: INTRODUCTION TO COMPUTER SYSTEM

UNIT 1: Compute System Parts

MODULE 2: SYSTEM ASSEMBLY AND INSTALLATIONS

UNIT 1: Computer Installation and Configuration

MODULE 3: MAINTENANCE TECHNIQUES

UNIT 1: Computer Maintenance

UNIT 2: Troubleshooting and Repair of Computer Systems

Recommended Texts

The following texts and Internet resource links will be of enormous benefit to you in learning this course:

1. https://en.wikipedia.org/wiki/Computer_hardware
2. http://www.computerhope.com/issues/ch001361.htmware
3. http://www.technologystudent.com/comps/comp12.htm
4. http://en.wikipedia.org/w/index.php?title=Computer_port_(hardware)&oldid=338140393
5. http://ecomputernotes.com/fundamental/input-output-and-memory/what-are-the-different-types-of-ram-explain-in-detail
6. http://www.desktopclass.com/education/computer-it/what-is-software-describe-different-categories-types-of-software.html
7. http://forfreeeducation.blogspot.com/2011/07/what-are-different-types-of-input.html

Assignment File

The assignment file will be given to you in due course. In this file, you will find all the details of the work you must submit to your tutor for marking. The marks you obtain for these assignments will count towards the final mark for the course. Altogether, there are tutor marked assignments for this course.

Presentation Schedule

The presentation schedule included in this course guide provides you with important dates for completion of each tutor marked assignment. You should therefore endeavour to meet the deadlines.

Assessment

There are two aspects to the assessment of this course. First, there are tutor marked assignments; and second, the written examination. Therefore, you are expected to take note of the facts, information and problem solving gathered during the course. The tutor marked assignments must be submitted to your tutor for formal assessment, in accordance to the deadline given. The work submitted will count for 40% of your total course mark.

At the end of the course, you will need to sit for a final written examination. This examination will account for 60% of your total score. You will be required to submit some assignments by uploading them to CPT 226 page on the u-learn portal.

Tutor-Marked Assignment (TMA)

There are TMAs in this course. You need to submit all the TMAs. The best 10 will therefore be counted. When you have completed each assignment, send them to your tutor as soon as possible and make certain that it gets to your tutor on or before the stipulated deadline. If for any reason you cannot complete your assignment on time, contact your tutor before the assignment is due to discuss the possibility of extension. Extension will not be granted after the deadline, unless on extraordinary cases.

Final Examination and Grading

The final examination for CPT 226 will last for a period of 1 hours and has a value of 60% of the total course grade. The examination will consist of questions which reflect the self-assessment questions and tutor marked assignments that you have previously encountered. Furthermore, all areas of the course will be examined. It would be better to use the time between finishing the last unit and sitting for the examination, to revise the entire course. You might find it useful to review your TMAs and comment on them before the examination. The final examination covers information from all parts of the course.

Practical Strategies for Working Through This Course

1. Read the course guide thoroughly
2. Organize a study schedule. Refer to the course overview for more details. Note the time you are expected to spend on each unit and how the assignment relates to the units. Important details, e.g. details of your tutorials and the date of the first day of the semester are available. You need to gather together all this information in one place such as a diary, a wall chart calendar or an organizer. Whatever method you choose, you should decide on and write in your own dates for working on each unit.
3. Once you have created your own study schedule, do everything you can to stick to it. The major reason that students fail is that they get behind with their course works. If you get into difficulties with your schedule, please let your tutor know before it is too late for help.
4. Turn to Unit 1 and read the introduction and the learning outcomes for the unit.
5. Assemble the study materials. Information about what you need for a unit is given in the table of content at the beginning of each unit. You will almost always need both the study unit you are working on and one of the materials recommended for further readings, on your desk at the same time.
6. Work through the unit, the content of the unit itself has been arranged to provide a sequence for you to follow. As you work through the unit, you will be encouraged to read from your set books

7. Keep in mind that you will learn a lot by doing all your assignments carefully. They have been designed to help you meet the objectives of the course and will help you pass the examination.
8. Review the objectives of each study unit to confirm that you have achieved them.

If you are not certain about any of the objectives, review the study material and consult your tutor.

9. When you are confident that you have achieved a unit's objectives, you can start on the next unit. Proceed unit by unit through the course and try to pace your study so that you can keep yourself on schedule.
10. When you have submitted an assignment to your tutor for marking, do not wait for its return before starting on the next unit. Keep to your schedule. When the assignment is returned, pay particular attention to your tutor's comments, both on the tutor marked assignment form and also written on the assignment. Consult you tutor as soon as possible if you have any questions or problems.
11. After completing the last unit, review the course and prepare yourself for the final examination. Check that you have achieved the unit objectives (listed at the beginning of each unit) and the course objectives (listed in this course guide).

Tutors and Tutorials

There are few hours of tutorial provided in support of this course. You will be notified of the dates, time and location together with the name and phone number of your tutor as soon as you are allocated a tutorial group. Your tutor will mark and comment on your assignments, keep a close watch on your progress and on any difficulties you might encounter and provide assistance to you during the course. You must mail your tutor marked assignment to your tutor well before the due date. At least two working days are required for this purpose. They will be marked by your tutor and returned to you as soon as possible.

Do not hesitate to contact your tutor by telephone, e-mail or discussion board if you need help. The following might be circumstances in which you would find help necessary: contact your tutor if:

i. You do not understand any part of the study units or the assigned readings.
ii. You have difficulty with the self-test or exercise.
iii. You have questions or problems with an assignment, with your tutor's comments on an assignment or with the grading of an assignment.

You should endeavour to attend the tutorials. This is the only opportunity to have face to face contact with your tutor and ask questions which are answered instantly. You can raise any problem encountered in the course of your study. To gain the maximum benefit from the course tutorials, have some questions handy before attending them. You will learn a lot from participating actively in discussions.

GOODLUCK!

Table of Contents

Module 1

Introduction to Computer System

Unit 1: Computer System Parts

Unit 1

Computer System Part

Content

1.0 Introduction

The study of hardware system maintenance is an important part of the core of Computer Science. From course CPT 111 we have been exposed to history of computing, whereby we have the privilege to know how computer came about its components, input and output devices. But the study of the hardware system maintenance is a vital issue that cannot be left out as it plays a major role in computing.

In this study, unit you will learn intensively system hardware, the different between input and output devices, the system software and how it is different from the hardware systems.

2.0 Learning Outcomes

At the end of this unit, you should be able to:

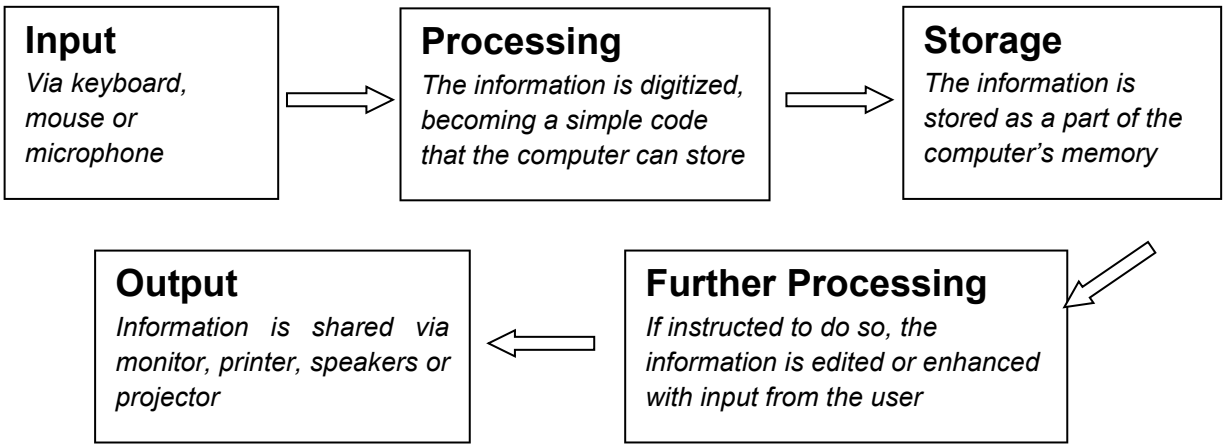
1. Get a simple idea of how a computer system works
2. Define the hardware
3. Give a brief explanation of basic hardware components.
4. Know your input and output devices and how they differ
5. Understand the various types of software

3.0 Learning Content

3.1 Basic Computer Technical Knowledge

How a Computer works

A computer is a fabulous instrument that turns human inputs into electronic information that it then can store or share/distribute through various output devices. A computer performs (if instructed to do so) the steps shown in the diagram below, using information that a user provides (such as a typed sentence):



All of the equipment (hardware) and the instructions (software) needed to complete the above steps are described in the next section.

Amazingly, the information that the user inputs into a computer is processed so that it becomes a simple code made up of only two digits, zero and one! For all its complexity, a computer is only able to handle these two choices. This is because it is based on electrical signals that have only two options (such as either on or off). But computers compensate for this very simple code by using it in huge quantities.

A single unit of this zero/one code is called a bit. Grouping 8 bits together makes a unit of information called a byte. Typing a single page of typed text on a computer requires a minimum of about 20 kilobytes (20 KB or 20,000 bytes) of information to be stored. Good quality digital photographs are usually 1 megabyte (1 MB or 1,000,000 bytes) or larger. So a computer is a very "busy" machine indeed!

3.2 Hardware

Hardware is the collection of all the parts you can physically touch. We can also define it as the physical parts or components of a computer system.

3.2.1 The basic hardware parts are briefly described as follows:

Computer case: The computer case is a plastic or metal enclosure that houses most of the component of a computer system. It has attachment points, slots and screws that allow these parts to be fitted onto the case. The case is also sometimes called the CPU, since it houses the CPU (central processing unit or processor)

The above diagram is how a system casing looks like. Please remember that it comes in various shapes and sizes, depending on the type you want.

Power Supply: Provides electrical power to motherboard, disk drives, and occasionally to the monitor also. The power supply unit built into a personal computer converts the input AC voltage to different DC voltages. Some components receive their supply directly from the PSU, others indirectly by way of circuitry on the motherboard.

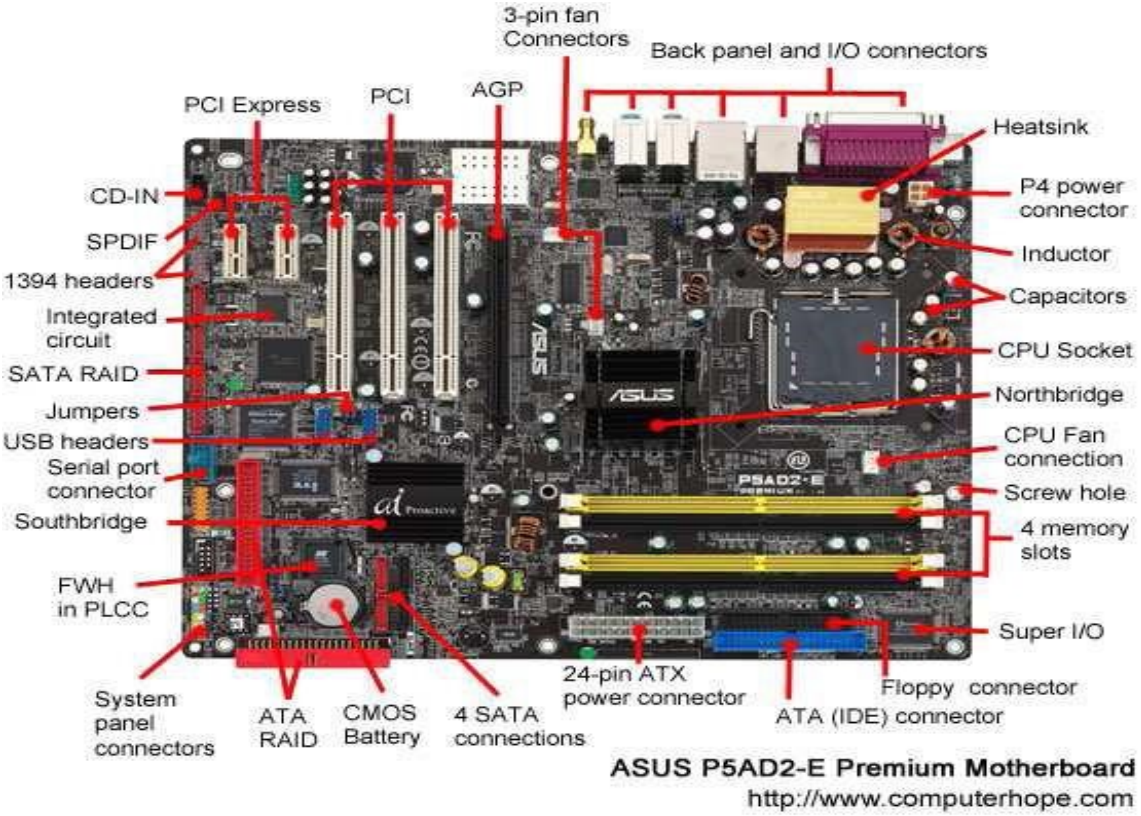
It has a fan on it to cool the computer. The power supply is used to connect all of the parts of the computer. It is usually is found at the back of the computer case. The diagram below gives you an idea of how a power supply looks like.

Motherboard: The motherboard is a large electronic board that is used to connect the power supply to various other electronic parts, and to hold these parts in place on the computer. The computer's memory (RAM, described below) and processor are attached to the motherboard. Also found on the motherboard is the BIOS (Basic Input and Output System) chip that is responsible for some fundamental operations of the computer, such a s linking hardware and software.

The motherboard also contains a small battery (that looks like a watch battery) and the chips that work with it to store the system time and some other computer settings.

Motherboards are the most important part of a computer unit, although there are many

Manufacturers but each keep to a standard layout to ensure that their motherboards are compatible with a range of accessories and components below describes the motherboard.



Below is the brief explanation of some of the parts of a motherboard:

1394 header and USB header: The 1394 header and USB header is a pin connection found on a computer motherboard that allow additional 1394 and USB.

Connections to be added to the computer for example, if you wanted to add additional USB connections to the front of your computer a USB add-on could be added into one of the drive bays and connected to the USB header. The picture shows an example of what the 1394 and USB headers look like on a computer motherboard. As can be seen in the picture, both the 1394 and USB headers have nine pins and closely resemble each other.

Every motherboard is different, the 1394 or USB header on your motherboard may only have four or five pins.

Caution: Plugging a 1394 header cable into the USB header connection or the USB header cable into a 1394 connection will damage a motherboard. Always consult your motherboard manufacturer manual before connecting anything to the 1394 or USB header. Below is a diagram that shows how it looks like.

1394 headers

USB headers

http://www.computerhope.com

ATX style connector: This is a replacement for the older P8and P9 AT style connector. It is one of the largest connectors inside a computer. It connects a power supply to an ATX style motherboard.

Note: with the introduction of **ATX-2**, this cable is now a24-pin cable and no longer a 20-pin cable. As seen in the pictures, the cable has a small clip on the top of the cable that should snap and hold the cable in place. This cable is also keyed, which means it only connects in one direction.

ATX style connector

ATX style power supply connector cable

Capacitor: A capacitor is a component made of two or sets of two conductive plates with a thin insulator between them and wrapped in a ceramic and plastic container. When the capacitor receives a direct current (DC), a positive charge builds up on one of the plates (or set of plates) while a negative charge builds upon the other.

This charge, which is measured in microfarads on a computer capacitor, remains in the capacitor until it is discharged. The first image is an example of what a capacitor may look like on a computer motherboard. Another common type of capacitor is an electrolytic capacitor, which is a higher capacitance capacitor in a smaller package.

The second picture is a capacitor that can fail and when they do, it can cause the computer or the component to malfunction. In the case of a motherboard, when a motherboard capacitor fails the computer will no longer boot, and the capacitor needs to be replaced or anew motherboard needs to be put in the computer.

The picture below is an example of an ABIT VP6 motherboard with blown capacitors and one example of how a capacitor may fail. Blown capacitors can be replaced, but for most users replacing the motherboard is often the easiest solution.

CMOS: Alternatively referred to as a Real-Time Clock (RTC), Non-Volatile RAM (NVRAM) or CMOSRAM, CMOS is short for Complementary Metal-Oxide Semiconductor. CMOS is a non-board, battery powered semiconductor chip inside computers that stores information. This information ranges from the system time and date to system hardware settings for your computer. The picture shows an example of the most common CMOS coin cell battery used to power the CMOS memory.

The CMOS stores all the basic information on the computer system. The battery charges up when the computer is turned on. If the battery was to be removed the standard information held in the CMOS, such information regarding the hard drive will need refreshing. An indicator of a battery losing its charge is that it will not keep time accurately.

How long does the CMOS battery last?

The standard lifetime of a CMOS battery is around 10 Years. However, these can vary depending on the use and environment in which the computer resides. If the battery fails, the system settings, date, and time will not be saved when the computer is turned off until it has been replaced.

CMOS BATTERY

Coil: Short for **electromagnetic coil,** is conductor wire such as copper in a cylindrical form around an iron core that creates an **inductor** or electromagnet to store magnetic energy. Coils are often used to remove power spikes and dips from power. The picture is an example of an inductor on a computer motherboard.

Inductor coil

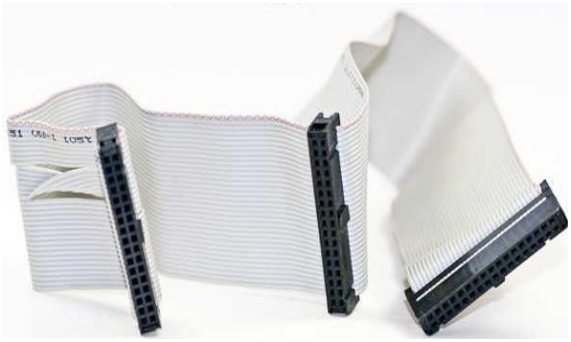
CD-IN: Alternatively referred to as the **optical drive audio connector**, the **CD-IN** is a four-pin connector found on a computer smother board or sound card that connects an optical drive studio. The picture shows a black four-pin connector and an example of what this connector looks like on a compute motherboard.

An example of how this connector could be used is connecting the four pin wire from the back of a CD-ROM drive to the connection on the motherboard, allowing the user to listen to an audio CD.

Optical drive audio connector (CD-IN)

Floppy cable: This is a ribbon cable found in PC computers that allow one or more floppy disk drives to be connected to a computer. As can be seen, this cable allows a desktop computer to have two floppy drives connected to one floppy controller.

Because floppy drives do not have a master or slave jumper, the drives are defined by cable select, which can be identified by looking for the cable twist as shown in the pictures. Like an IDE cable, most floppy cables also have a red strip along one side of the ribbon cable to indicate pin one, Today, if any floppy drive is in the computer it would be connected to "Drive A:" and the end cable connected to the motherboard.



Computer floppy drive cable

Corsair computer memory with heatspreader

Heat sink: A heat sink is an electronic device that incorporates either a fan or a peltier device to keep a hot component such as a processor cool. There are two heat sink types: **active** and **passive**.

Active heat sinks utilize power and are usually a fan type or some other peltier cooling device. If you are looking to purchase an active heat sink, it is recommended that you purchase fan switch ball-bearing motors that often last much longer than sleeve bearings. Sometimes these types of heat sinks are referred to as a **HSF**, which is short for **heat sink and fan**.

Passive heat sinks are 100% reliable, as they have no mechanical components. Passive heat sinks are made of an aluminum-finned radiator that dissipates heat through convection. For passive heat sinks to work to their full capacity, it is recommended that there is a steady air flow moving across the fins. The above picture is an example of a heat sink that is both active and passive.

Heat-spreaders are another name for heat sinks and commonly used to describe the covers on computer memory that helps dissipate the heat produced by the memory.

Active and Passive heat sink

IC: Alternatively referred to as a **bare chip**, **monolithic integrated circuit**, or **microchip**, **IC** is short for **Integrated-Circuit** or **Integrated Chip**. The IC is a package containing many circuits, pathways, transistors, and other electronic components all working together to perform a particular function or a series of functions. Integrated circuits are the building blocks of computer hardware. The picture is anexample of what an Integrated Circuit may look like on a circuit board today.

Integrated circuit

IDE: This is also known as **Integrated Drive Electronics** or IBM Disc Electronics, IDE is more commonly known as ATA or Parallel ATA (PATA). It is a standard interface for IBM compatible hard drives and CD or DVD drives. IDE is different than SCSI and Enhanced Small Device Interface (ESDI) because its controllers are on each drive, meaning the drive can connect directly to the motherboard or controller. IDE and its updated successor, Enhanced IDE (EIDE), are common drive interfaces found in IBM compatible computers.

Below is a picture of the IDE connector on the back of a hard drive, a picture of what an IDE cable looks like, and the IDE channels it connects to on the motherboard.

40-Pin IDE IDC Connector and cable

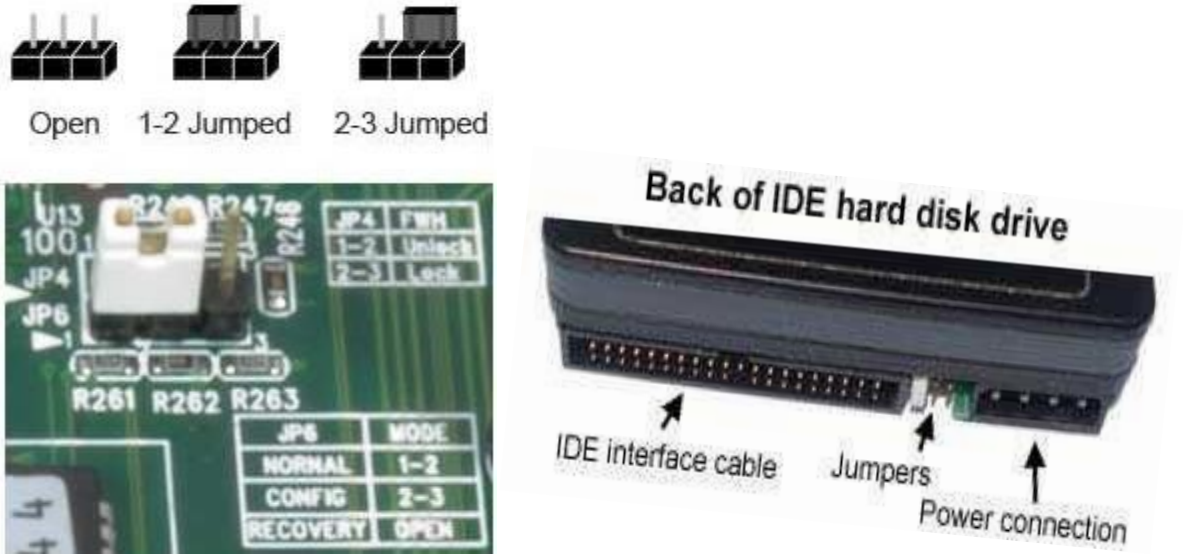
Jumper: This allows the computer to close an electrical circuit, allowing the electricity to flow certain sections of the circuit board. Jumpers consist of a set of small pins that can be covered with a small plastic box (**jumper block**). Below the illustration, is a picture of what the jumpers may look like on your motherboard.

In this example, the jumper is the white block covering two of the three gold pins. Next to the pins is a

Silkscreen description of each of the pin settings, in the picture jump pins 1-2 for Normal mode, 2-3 for con-fig mode, and when open the computer is in recovery mode.

Jumpers are used to configure the settings for computer peripherals such as the motherboard, hard drives, modems, sound cards, and other components. For example, if your motherboard supports edintrusion detection, a jumper can be set to enable or disable this feature.

In the past, before Plug-and-Play, jumpers were used to adjust device resources, such as changing what IRQ the device is using. Today, most users will not need to adjust any jumpers on their motherboard or expansion cards. Usually, you are most likely to encounter jumpers when installing a new drive, such as a hard drive. As can be seen in the picture below, ATA (IDE) hard drives have jumpers with three sets of two pins. Moving a jumper between each two pins will change the drive from master drive, slave drive, or cable select.



Computer jumper

Memory slot: This is also called a **memory socket**, or **RAM slot,** it is what allows computer memory (RAM) to be inserted into the computer. Depending on the motherboard, there may be 2 to 4**memory slots** (sometimes more on high-end motherboards) and is what determines the type of RAM used with the computer. The most common types of RAM are SDRAM and DDR for desktop computers and SODIMM for laptop computers, each having various types and speeds. In the picture below, is an example of what memory slots may look like inside a desktop computer. In this picture, there are three open available slots for three memory sticks. When buying a new computer or motherboard, pay close attention to the types of RAM the

memory slots, so you are familiar with what type of RAM to buy for your computer. It is also important to note how many available memory slots are available in your computer. It is not too common for computers to have all memory slots occupied, which means if you wanted to upgrade your computer memory some or all of the memory would need to be removed first.

Computer memory slots

Northbridge: Alternatively referred to as the **PAC** (PCI/AGP Controller), the **north-bridge** is an integrated circuit responsible for communications between the CPU interface, AGP, and the memory. Unlike the Southbridge the North-bridge is directly connected to these components and acts like a "bridge" for the Southbridge chip to communicate with the CPU, RAM, and graphics controller.

Today, the north-bridge is a single-chip that is north of the PCI bus; however, early computers may have had up to three separate chips that made up the north-bridge. The north-bridge is usually slightly larger than the south-bridge and is the closest to the CPU and memory. When the CPU needs data from RAM, a request is sent to the north-bridge memory controller.

After the request has been received, it responds with how long the processor need to wait to read the memory over the front side bus (FSB). However some resent motherboard does not come with a north bridge.

P4: The P4 connector is a 12V power supply cable like that shown in the picture used with motherboards that have an Intel Pentium 4 processor. The P4 cable has two black wire that serve as a ground and two yellow wires that are+12VDC.

P4 Connector

RAID: Short for Redundant Array of Inexpensive Disks, RAID is an assortment of hard drives connected and setup in ways to help protect or speed up the performance of a computer's disk storage. RAID is commonly used on servers and high performance computers.

S/PDIF: This is also called Sony and Phillips Digital Interconnect Format, the **S/PDIF** or **SPDIF** interface transmits digital audio in a compressed form between audio equipment and home theater systems. The S/PDIF interface can utilize a coaxial cable or a fiber optic cable to transmit the audio. Common equipment to use this interface is DVD Players and CD Players, connecting to a home theater system for Dolby Digital or DTS surround sound.

High quality sound cards and laptops also have this connector. In the first picture is an example of what the SPDIF connector may look like on your computer motherboard.

The audio transmitted is through the S/PDIF interface is defined by the IEC 61937 standard. In the second picture to the right, is an example of a fiber optic connection on the back of audio equipment.

Motherboard SPDIF connection

SATA: The full name for SATA is **Serial ATA**, **SATA** 1.0 was first released in August 2001and is a replacement for the Parallel ATA interface used in IBM compatible computers. Serial ATA is capable of delivering 1.5Gbps (1500 MBps) of performance to each drive within a disk array. It has the benefit of being backwards-compatible with ATA and ATAPI devices, and offers a thin, small cable solution, as seen in the photo below.

This cable helps make a much easier cable routing and offers better airflow in the computer when compared to the earlier ribbon cables used with ATA drives. SATA also supports external drives through **External SATA** more commonly known as **e-SATA**. E-SATA offers many more advantages when compared to other solutions. For example, it is hot-swappable, supports faster transfer speeds with no bottleneck issues like USB and Fire Wire, and supports disk drive technologies such as S.M.A.R.T.

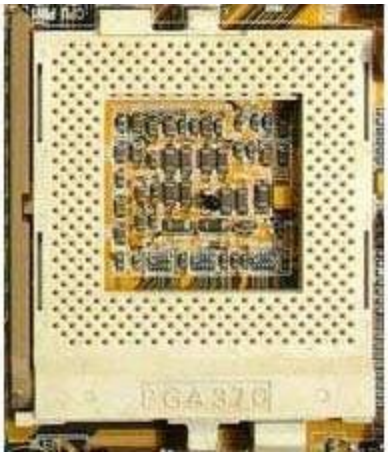
However, e-SATA does have some disadvantages such as not distributing power through the cable like USB, which means drives require an external power source. The e-SATA cable also supports a maximum length of up to 2m. Because of these disadvantages don't plan on e-SATA becoming the only external solution for computers.

SATA power cable

SATA data cable

SATA MB connections

Socket: When referring to a processor, a **CPU socket** or **processor socket** is a connection that allows the computer processorsto be connected to a motherboard. For example, the Socket 370 is an example of such a socket. The picture shows an example of what a socket may look like on another board. Although there have been computers that used the slot processor, most computers today and in the past have used socket processors.



Socket 370/PGA370

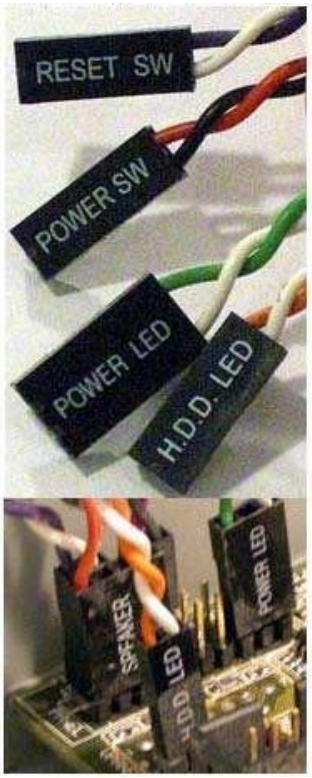
System panel connector: Alternatively referred to as the f-panel or front panel connector, the system panel connector or system panel header controls a computer

power button, reset button, and led's. The System panel cables, as shown in the picture are two wire cables that are color coded to help identify where they connect to the motherboard system panel connector.

The black or white wire is the ground (GND) wire and the colored wire is the powered wire. The cables, colors, and connections vary depending on the computer case and mother board you have, however, this generally include the cables mentioned below.

1. **HDD LED (IDE LED)** - The LED activity light for the hard drive. This is the LED that flashes as information is being written and read from the hard drive.
2. **Power LED (PLED)** - The LED power light, which indicates when the computer is on, off, or in Standby.
3. **Power SW (PWRSW)** - Controls the power button that allows you to turn on and off the computer.
4. **Reset SW** - Handles the reset button to restart the computer.
5. **Speaker** - The internal speaker used to sound the beep noises you hear from your computer when it is booting.

Please note that with most computer motherboards, the system panel cables are connected directly to the motherboard. However, some motherboard manufacturers such as ASUS include a **Q-Connector** with the motherboard. With a Q-Connector, the user can connect the system panel cables away from the motherboard and then connect the Q-Connector to the motherboard.



System Panel cable and connector

Standout: Sometimes referred to as a **standoff** and **spacer**, **standouts** is a small metal or plastic screws that attaches to a computer case and holds the motherboard to the case. The picture helps give an example of a standout. In this picture below, the left standout has as crew inserted in the hole to help demonstrate how it works. The motherboard would be placed between the standout and the screw.

Fuse: This act as a mini circuit breaker, a fuse is a resistor with a low tolerance designed to fail if excessive current flows through an electronic device.

Motherboard case standout

Case fan: This is also referred to as a system fan, a case fan is located inside a computer, attached to the front or back of its case. Case Fans help bring cool air into and blow hot air out of the case. They are available in a wide variety of sizes, but 80mm, 92mm, and 120mm (12cm) with a width of 25mm are the most common. Below is an example of how a computer case fan may look.

Expansion Slot: This is also called a bus slot or expansion port. An expansion slot is an opening located inside a computer on the motherboard or riser board that allows additional boards to be connected. For example, if you wanted to install a new video card in the computer you'd purchase a video expansion card and install that card into the compatible expansion slot.

Most computers have expansion slots on the motherboard that allow you to add various types of expansion cards.

Soundcard: The soundcard, also called an audio card, is responsible for what you hear in the speaker sore headphones. Most motherboard dishevels integrated sound, but you can upgrade to a dedicated sound card for higher-quality sound.

Network card: The network card allows your computer to communicate over an network and access the Internet. It can either connect with an Ethernet cable or through hard wireless connection (often called Wi-Fi). Many mother boards shave built-innate or connections, and an network card can also be added to an expansion slot.

Bluetooth card: Bluetooth is technology for wireless communication over short distances. It's often used in computers to communicate with wireless keyboards, mice, and printers. It's often built in to them other board or included in a wireless network card. For computers that don't have Bluetooth, USB adapter, called a dongle, can be purchased.

Dip Switch: A dip switch is a set of small switches in a dual in-line package (DIP) that is used to change the operating mode of a device. Dip switches are used to configure computer peripherals such as hard drives, modems, sound cards, and motherboards. They are often used as an alternative to jumpers because they are easier to operate and less likely to get lost. Today, dip switches are less common because most computers utilize Plug-and-Play, so hardware no longer requires manual configuration.

Processor: The processor is the main “brain” of a computer system. It performs all of the instructions and calculations that are needed and manages the flow of information through a computer. It is also called the CPU (central processing unit), although this term can also be used to describe a computer case along with all of the hardware found inside it.

Another name for the processor is a computer “chip” although this term can refer to other lesser processors (such as the BIOS). Processors are continually evolving and becoming faster and more powerful. The speed of a processor is measured in megahertz (MHz) or gigahertz (GHz).

An older computer might have a processor with a speed of 1000 MHz (equivalent to 1 GHz) or lower, but processors with speeds of over 2 GHz are now common. One processor company, Intel, made a popular series of processors called Pentium. Many reconditioned computers contain Pentium II, Pentium III and Pentium 4 processors, with Pentium 4 being the fastest of these.

Please note that the processor comes in different shapes and sizes depending on its manufacturer.

Random Access Memory :(**RAM**) this is also called the C*omputer Memory*. The Read and write (R/W) memory of a computer is called RAM. The User can write information to it and read information from it. With Ram any location can be reached in a fixed (and short) amount of time after specifying its address.

The RAM is a volatile memory; it means information written to it can be accessed as long as power is on. As soon as the power is off, it cannot be accessed. So this means RAM computer memory essentially empty.RAM holds data and processing instructions temporarily until the CPU needs it.

RAM is considered "**random access**" because you can access any memory cell directly if you know the row and column that intersect at that cell. RAM is made in electronic chips made of so called semiconductor material, just like processors and many other types of chips. In RAM, transistors make up the individual storage cells which can each "remember" an amount of data, for example, 1 or 4 bits – as long as the PC is switched on. Physically, RAM consists of small electronic chips which are mounted in modules (small printed circuit boards). The modules are installed in the PC's motherboard using sockets – there are typically 2, 3 or 4 of these.

There are two basic types of RAM:

(i) Dynamic Ram

(ii) Static RAM

Dynamic RAM: loses its stored information in a very short time (for milli sec.) even when power supply is on. D-RAM' is cheaper & lower.

Similar to a microprocessor chip is an Integrated Circuit (IC) made of millions of transistors and capacitors. In the most common form of computer memory, Dynamic Memory Cell represents a single bit of data. The capacitor holds the bit of information – a 0 or a 1. The transistor acts as a switch that lets the control circuitry on the memory chip read the capacitor or changes its state. A capacitor is like a small bucket that is able to store electrons. To store a 1 in the memory cell, the bucket is filled with electrons.

To store a 0, it is emptied. The problem with the capacitor's bucket is that it has a leak. In a matter of a few milliseconds a full bucket becomes empty. Therefore, for dynamic memory to work, either the CPU or the Memory Controller has to come along and recharge all of the capacitors holding it before they discharge. To do this, the memory controller reads the memory and then writes it right back. This refresh operation happens automatically thousands of times per second.

Computer ROM: A good example of ROM in the computer is the computer BIOS, a PROM chip that stores the programming needed to begin the initial computer startup process. Using a non-volatile storage is the only way to begin the startup process for computers and other devices that use a similar startup process. ROM chips are also used in gaming system cartridges, like the original Nintendo, Game boy, Sega Genesis, and a number of others. The game cartridge stores the game programming on a ROM chip that is read by the game console when the cartridge is inserted into the console.

The oldest ROM-type storage media can be dated back to 1932 with drum memory. Today, ROM-type storage media is still used and continues to be improved upon for better performance and storage capacity.

Hard-drive: The hard drive on your computer is where the software is installed, and it's also where your documents and other files are stored. The hard drive is long-term storage, which means the data is still saved even if you turn the computer offer unplug it.

When you run a program or open a file, the computer copies some of the

data from the hard drive on to the RAM. When you save a file, the data is copied back to the hard drive. The faster the hard drive is, the faster your compute can startup and load programs. The diagram below shows how a hard drive looks like.

Peripheral hardware: Peripheral hardware is the name for the computer components that are not found within the computer case. This includes input devices such as a **mouse, microphone** and **keyboard**, which carry information from the computer user to the processor, and output devices such as a **monitor, printer** and **speakers**, which display or transmit information from the computer back to the user**.**

Computer Ports: The peripheral hardware mentioned above must attach to the computer so that it can transmit information from the user to the computer (or vice versa). There are a variety of ports present on a computer for these attachments. These ports have gradually changed over time as computers have changed to become faster and easier to work with. Ports also vary with the type of equipment that connects to the ports. A computer lab manager should become familiar with the most common ports (and their uses), as described below.

Serial Port: This port for use with 9 pin connectors is no longer commonly used, but is found on many older computers. It was used for printers, mice, modems and a variety of other digital devices.

Parallel Port: This long and slender port is also no longer commonly used, but was the most common way of attaching a printer to a computer until the introduction of USB ports (see below). The most common parallel port has holes for 25 pins, but other models were also manufactured.

VGA: The Video Graphics Array port is found on most computers today and is used to connect video display devices such as monitors and projectors. It has three rows of holes, for a 15 pin connector.

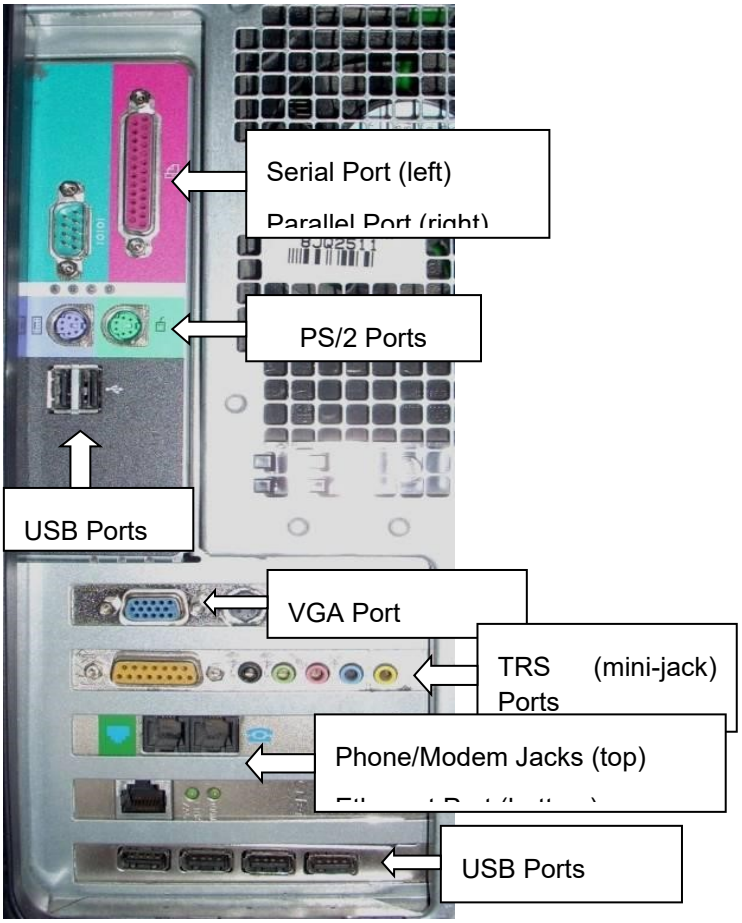
PS/2: Until recently, this type of port was commonly used to connect keyboards and mice to computers. Most desktop computers have two of these round ports for six pin connectors, one for the mouse and one for the keyboard.

USB: The Universal Serial Bus is now the most common type of port on a computer. It was developed in the late 1990s as a way to replace the variety of ports described

above. It can be used to connect mice, keyboards, printers, and external storage devices such as DVD-RW drives and flash drives. It has gone through three different models (USB 1.0, USB 2.0 and USB 3.0), with USB 3.0 being the fastest at sending and receiving information. Older USB devices can be used in newer model USB ports.

TRS:TRS (tip, ring and sleeve) ports are also known as ports for mini-jacks or audio jacks. They are commonly used to connect audio devices such as headphones and microphones to computers.

Ethernet: This port, which looks like a slightly wider version of a port for a phone jack, is used to network computers via category 5 (CAT5) network cable. Although many computers now connect wirelessly, this port is still the standard for wired networked computers. Some computers also have the narrower port for an actual phone jack. These are used for modem connections over telephone lines.



Back of Desktop Computer Showing Ports

Self-Assessment Exercise(s)

1. List 5 different components of a computer system, and explain them in your own understanding.
2. You can use a physical desktop open it and try to identify the thing you can see?

Self-Assessment Answer(s)

The ten different component of computer system there are as follows:

1. **Motherboard:** is one of the most essential parts of a computer system. It holds together many of the crucial components of a computer, including the central processing unit, memory and connectors for input and output devices.
2. **Central Processing Unit:** is a brain of a computer where most calculations take place.
3. **Memory:** is a temporary storage area. It holds the data and instruction that the central processing unit need before a program can be run, the program is loaded from some storage medium into the memory.
4. **Video and Sound Card:** is a piece of hardware that turns digital data into analog sound wave that you hear.
5. **Network Interface Card:** is computer hardware that component that connects a computer to network.

3.2.2 Input and output devices

This is the first and last of the four stages of computing, Information is inputted to the computer from external sources such as a keyboard, camera, microphone, and so forth and then it is processed. The data is stored, either temporarily, or more permanently.

The data is outputted in a form that humans can understand, such as text, graphs, pictures, and sounds. Input devices are used to enter data and instructions into computer memory from external world. Examples include: Keyboard, Mouse, Track ball, Track Pad, Joy stick, Touch Screen, Light pen, Touch Screen, Scanner, Digital Camera, Microphone, Graphics tablet. They perform three main functions

3.2.2.1 Types of input devices

The keyboard: This is the most common device for providing information, In order to be able to process and manipulate data, the information must be inputted and presented in a digital format that the computer can understand and process. Below is a picture of how a keyboard looks like.

The mouse: Mouse is an input device used to control motion of pointer on screen. A mouse has two or three buttons called Left, Right and Middle button. Buttons are used to perform different functions. It has a rubber or metal ball inside its body. Mouse is rolled over a flat surface called mouse pad. The movement of ball is detected by internal circuits of mouse. These circuits convert this movement into digital signals, which are sent to computer. Mouse is used in graphical applications. It is also used for playing video games on computer.

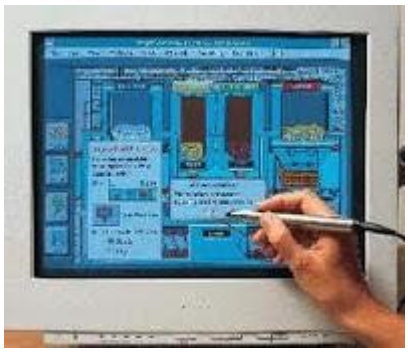
Track Ball: Track Ball is an input device like a mouse. It is used in Lap top computers to control motion of pointer on screen. It is a pointing device like upside down mouse. It has a ball on its upper side. This ball is moved by fingers or thumb and the pointer moves accordingly on screen.

Track Pad: Track pad is a pointing input device. It is used in Lap top computers to control motion of pointer on screen. Track pad is a stationary input device. It has a flat surface of 1.5 to 2 square inch. Finger is moved on this surface to move pointer on screen.

Joy stick: Joystick is an input device used to play games on computer. It is used to control motion of an object quickly in game with the help of a hand held stick. This stick can be moved forward, backward or sideways. This stick is mounted on a ball. When stick is moved the ball is moved and signals are sent to the computer.

Light Pen: Light pen is an input device consisting of a special pen that is connected to a computer's monitor. The user points at the screen with the pen and selects items or chooses commands either by pressing a clip on the side of the light pen or by pressing the light pen against the surface of the screen (the equivalent of performing a mouse click).

Microphone: Microphone is an input device used to enter sounds into the computer. We can record sounds in computer with the help of microphone and sound card.

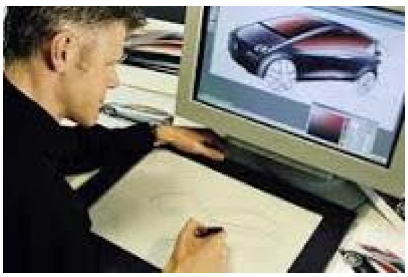


Scanner: Scanner is an input device. It is used to save pictures or text on paper into computer memory. It converts picture or text on paper in to binary form and saves it in computer memory. With the help of scanner, we may save our time to type a lot of text.

For example, if we have a book and wish to enter the whole text of book in to computer It will be a long, tedious and time consuming job. But if we use a scanner, we can do

this with in less time. We can scan each page of book. Editing of the scanned text is also possible. So our job will become very easy with the help of a scanner.

Graphics tablet / digitizer: A graphics tablet consists of a special pen called stylus and a flat pad. The image is created on the monitor screen as the user draws it on the pad with the help of stylus (special pen). Graphics tablet is also called a digitizer as show below,



Touch Screen: In ATM and in latest smart phones, touch screen is used to receive input from the user. The user enters data by the touch of his finger on different menu options or icons present on touch screen.

Digital Camera: A digital camera is one of the latest input devices. We can take pictures with the help of digital camera. These pictures are saved on digital camera's internal memory. There is no need of a film role as used in traditional cameras. Later on we can easily input these pictures with the help of a data cable into computer's memory. Latest digital cameras can take still snapshots and can record video as well.

Output devices: Output devices are used to display results of processing to the user, When the data has been processed and manipulated inside the computer, it is often converted from its digital form and output to a device as information in a way that humans can understand They perform the following functions;

Receive results from memory, Convert data into human readable form and Display results to the user.

Examples include: Monitor, printer, plotter, speaker, and multimedia projector.

Monitor: A monitor displays the text and graphics generated by the computer, it is the most commonly used output device used to display results of processing. It has a TV like shape. Pictures on monitor are formed with picture elements called PIXEL. Monitors may be Monochrome that will display results in Black & White. Color Monitors are also available. They display results in multi colors. Monitor produces soft copy output. There are two types of monitors they are shown in the diagram below;

LCD-Monitor

CTR-Monitor

Printers: The printer produces a paper copy of information generated by the computer. We can also say that they are used to produce a hard copy output. They print processing results on paper. Printers are divided into two main categories:

- Impact Printers
- Non-Impact printers

Impact Printers: These printers print with striking of hammers or pins on ribbon. For example, Dot Matrix printer and daisy wheel printers are impact printers.

Non-Impact Printers: These printers do not use striking mechanism for printing. They use electrostatic and laser technology. Quality and speed of these printers is better than Impact printers. For example Laser printer and Inkjet printers are non-impact printers. They print documents in black and white or in colored depending of the type u get.

Speakers: Speaker produces sound output. We can listen recorded voices, sounds or music with the help of speaker. Speaker produces sound output with the help of sound card.

Plotter: Plotters are used to draw different designs of buildings or internal structure of machines. Mostly Engineers and Architects use plotters

Multimedia Projector: Multimedia projector is used to produce computer output on a big screen. These are used in meeting rooms or in classrooms ofeducational institutes.

Multimedia Projector

Self-Assessment Exercise (SAE 2)

1. Differentiate between input and output devices and give examples.

Self-Assessment Answer(s)

Depending on the interaction, a device can be both referred as an input/output device. An input device is a component used to feed information to computer, where an output device gives processed information back to the user.

3.3 Software

A set of instructions given to computer to solve a problem is called **software.** Software is also known as program. Computer software specifies a sequence of operations to be performed by computer. A computer works according to the instructions written in software.

Types of Software

Software can be divided into the following categories:

i. System software

ii. Application software

1. System Software: This is a set of programs used to control and manage the operations of computer hardware. It controls the usage and allocation of different

hardware components. It enables application programs to execute properly. It controls the basic operations as follows:

i. Saving data on disk
ii. Making computer to work for us
iii. Printing a document etc.

Examples of System Software

Some examples of system software are as follows:

i. Operating System
ii. Utility Programs
iii. Device Drivers

2. Application Software: Application software is used to perform various applications on the computer. It helps a computer user to perform specific tasks. People use application software according to their needs. It is also known as **application package**.

Categories of Application Software

The main categories of application software are as follows:

a) Customized Software

Customized software is a type of application software that is designed for a particular customer or organization. It is developed to meet the exact requirements of a particular customer or organization. Customized software can be developed by single programmer or a team of programmers. The cost of customized software is more than packaged software.

Example

Software that is developed for a particular university is an example of customized software.

b) Package Software

Package software is a type of application software that is developed for sale to the general public. It is also known as **off – the – shelf** software. It enables the people to perform daily activities. Package software is normally developed by expert programmers.

Examples

Some examples of package software are as follows:

i. Word processor such as MS word.
ii. Spreadsheet such as MS excel and Lotus 123 etc.
iii. Database software such as MS access and Oracle etc.
iv. Graphics software such as CorelDraw and Adobe Photoshop etc.

System Software	Application Software
It is general-purpose software	it is specific purpose software

It is used to manage computer resources	It is used to solve particular problems.
It executes all the time in computer	It executes as and when required.
The number of system software is less than Application software.	The number of application software is much more than system software
System software is essential for computer To work.	Application software is not essential for a Computer to work.

Self-Assessment Exercise(s)

1. Which of the following is normally classified as application software?
   a. Word processing software
   b. File management
   c. Web browser
   d. Operating system
   e. Multimedia software
   f. Disk operating system
2. List the different types of software that you know.

Self-Assessment Answers

1. Word processing software, web browser and multimedia software are the application software, this is because as stated “application software are software’s or group of program that designed for the end user to performed specific task. While system software includes program that are dedicated to managing the computer itself.
   a. Word processing software allows user to create document and perform calculation. Example: MS word, word pad etc.
   b. Multimedia software allows user to create image, audio etc. Example: Real player, Media player etc.
   c. Web browser is software that is run from internet. Example: online games, virus protection software etc.
2. The two types of software’s that I know they are as follows:
   a. System software
   b. Application software

4.0 Conclusion

In this unit you have gotten the overview of computer hardware, the detailed explanation of the motherboard as well as the other components of the hardware, the different types of input and output devices, and the software in brief. These serves as introduction to this course title Hardware systems and maintenance.

5.0 Summary

In this Module 1Study Unit 1, the following aspects have been discussed:

1. The different types of a computer hardware and software.
2. Input and output devices
3. Components of a computer system.

6.0 Tutor-Marked Assignment (TMA)

Open a system preferably your own desktop and take a close look of the motherboard,

List and explain the different component of the motherboard.

7.0 References/Further Reading/ Further reading

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