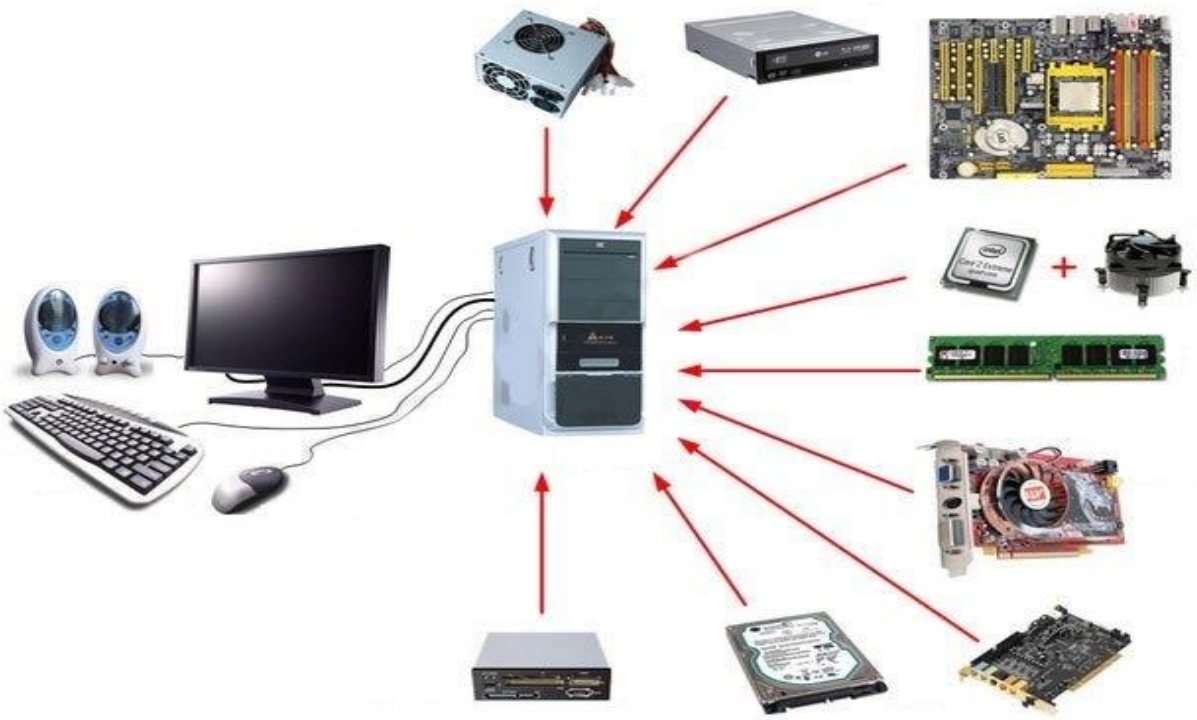
BHADRAK ENGINEERING SCHOOL & TECHNOLOGY
(BEST), ASURALI, BHADRAK

COMPUTER HARDWARE & MAINTENANCE (Th-3)

(As per the 2020-21 syllabus of the SCTE&VT, Bhubaneswar, Odisha)



Fifth Semester

COMPUTER SCIENCE & ENGG.

Prepared By: Er. T.K.Ojha

CHAPTER-1

Sl.no	Name of the Chapter as per the Syllabus	Expected marks
1	Computer Centre Management	10
2	Site Preparation & Installation	10
3	Mother Board and Components	25
4	Memory and I/O Devices	25
5	Display, Power Supply and Bios	10
6	Maintenance and Trouble Shooting	15
7	Networking Devices and Their Interfaces	10
Total		105

COMPUTER CENTRE MANAGEMENT

_1.1 NEED OF MANAGEMENT IN COMPUTER CENTRE

1.2 TYPES OF JOBS CARRIED OUT IN COMPUTERS IN AN ORGANIZATION

1.3 DUTIES AND RESPONSIBILITIES OF PERSONNEL INVOLVED

1.4 NEED FOR TRAINING OF STAFF

1.5 IDEA ABOUT VARIOUS MAKES OF COMPUTERS

1.1 NEED OF MANAGEMENT IN COMPUTER CENTRE

The need for a good management of a computer center cannot be ruled out in the present context of expensive computer era. A good management in a computer center provide the following environment to the layer of a computer center.

- The management is responsible for providing required time slot to each user or user group without any overlapping.
- The management is responsible for distributing the material resources in the computer hardware, software air and peripheral devices to the computer useron priority basis.

- The management is responsible for maintaining the proper environment of a computer Centre so that the computer hardware and software are protected from dust, high temperature, power fluctuation, humidity, etc.
- The management is responsible for guiding the computer users so that they can use the computer in optimized manner.

Therefore, in absence of a good management of a computer Centre and the resources available in a Centre may be miss-utilized or underutilized.

1.2TYPES OF JOBS CARRIED OUT IN COMPUTERS IN AN ORGANIZATION

Some jobs that are carried out in an organization through computer are givenbelow.

- Word Processing
- Networking
- Data Processing
- CAD/CAM
- Accounting

Word Processing

- It implies the use of a computer-based system for entering, editing, storing and printing of a textual matter.
- This can be in a form of letter, memo, report, manual,draft and almost all document required for an office.

Networking

- Network planning is the latest buzz and in the computer science. Computer networkcan be utilized to co-ordinate activities in the distant places without any delay.

Data Processing

- The term data processing means the process of collecting all items of data to get this to produce meaningful information.
- It is a term mostly associated with businessand commercial work but it does involve scientific data processing, the process is called electronic data processing (EDP).

CAD/CAM

- Computer aided design makes the task simple for the designer to draw a design which can be drawn on monitor of a computer.

- It is possible to make any changes during this design phase. After the completion of the design the final diagram is prepared.
- Computer aided manufacturing is used for manufacturing processes.
- TheCAM package software is used for this purpose. Much of the information generatedby CAD system is utilized in CAM. Various machines and tools are controlled by computer to produce high quality products.

Accounting

- Computer helps in accounting in bank and other offices with electronic spreadsheetlike Microsoft excel. Some accounting package used for accounting are Tally, etc.

1.3DUTIES AND RESPONSIBILITIES OF PERSONNEL INVOLVED

The duties and responsibilities of personnel involvement in the computer center canbe categorized into six types.

- Marketing Group
- Internal Training Group
- System Software Group
- Hardware Consulting Group
- Program Manager
- Programmer

Marketing Group

This group of personnel possesses average technical idea on computer. They are responsible for creating a market on the products which the company deals. Thesegroup of personal works like a supplement to the sells group.

Internal Training Group

- This group of people should have a good technical skill as well as good communication skill. They are responsible for planning and conducting the trainingof professionals within the organization so as to help them in self-development.
- Forthis purpose, the groups carry out the comprehensive survey of qualification and jobexperience of a professional working in the organization.

System Software Group

- This group is responsible for providing system programming support to the computercentre and help the professional within the division.
- For this purpose, the group takes up system generation works for the system software available in the computer.

- Apart from this they also design other system software to provide easy platform to the application program.

Hardware Consulting Group

- This group provides all hardware support to the computer Centre. They are responsible for minimizing the system down time in the computer Centre. They alsohelp the application programmer in integrating different peripheral devices to the different system where required.

Program Management

- This group is responsible for providing the necessary information about the ongoingpractices to the programming staff. This group is a field group who actually enquiries and realizes needs, limitations, reliability, etc of the project and passes the same to the programming group.

Programmer

- This group is responsible for providing the end product to the customer. They takesupport from various groups and convert them into programming language code.

1.4 NEED FOR TRAINING OF STAFF

- The need for training to staff is a very essential process for any organization. Above all if the organization is technical or Computer Based organization then a need for training becomes inevitable.
- The basic objective of conducting training is to update the knowledge of the staff to make them aware of the latest development in the consumer field, the kind of training the person will undertake depends uponthe fact that which level of the person belongs.

If the person belongs to top level management then the need for training in thecomputer will be as follows:

- To study the recent advancement in the field of hardware and software.
- To provide training in the design, development and implementation ofComputer Based systems.
- To have an exploration in the capability of the computer.
- To have an idea in forming the strategies for and orderly change in the workculture.
- To have an exposure in the operation research technique relevant to theirspecific operation.

If the person belongs to middle level management then the need for training inthe computer will be as follows:

- To get an exposure to the recent computer concept in terms of h/w and s/w.
- To get an exposure in the Management Information System (MIS).
- To have a detailed idea in the updated software those are used at their level.
- To get awareness about numerical methods, linear programming, computersimulation, etc.

If the person belongs to low level management then the need for training in thecomputer will be as follows:

- Training in the latest computer concept.
- Training in the latest programming method which is relevant to theapplication.
- Training in the latest application package related to the application area.
- Training in various operating systems and which they expected to work.

Basically, the need for training to the staff of an organisation includes thefollowing points.

- To get an understanding of the managerial decision-making process and to evolve an interdisciplinary approach for planning, analysis, design and implementation of Computer Based information systems.
- To develop an understanding and knowledge of Tools and techniques in the design of software systems for implementing Computer Based information systems.
- To expose the participants to update computer systems.

1.5IDEA ABOUT VARIOUS MAKES OF COMPUTERS

There are two types of hardware architecture or makes followed to makecomputers.

- IBM architecture USA
- Apple computer UK

Following are some International companies which follows IBM PC architecture:

HP (Hewlett Packard), Compaq, Dell, NEC, SEAR, etc.

Following are some national companies making IBM PC clones:

Wipro, Zenith, HCL, etc.

Following are some international software companies:

Microsoft, Oracle, Google, Novel, etc.

Computer service

1. There are organizations which go to any other manually organized enterprise on theinvestigation and understand their various operations in producing the product andreplace all the manual system with computers, also make the employees trained. **Following are some of the organization which provide Computer Services:** Satyam, Wipro, TCS, Penta Soft, etc.

Following institutes are providing training for both carrier concept, professionalcounselling, etc:

Aptech, CNC, SSI, INCA, NIIT, etc.

Short question

1. What is word processing?
   - Ans:-Word Processing refers to the act of using a computer to create, edit, save and print documents. ...
   - One example of a Word Processor is Microsoft Word, but other word processing applications are also widely used.
   - Examples include: Microsoft Works Word Processor, Open Office Writer, Word Perfect and Google Drive Document..
2. Define accounting.
   - Accounting is the process of recording financial transactions pertaining to a business.
   - The accounting process includes summarizing, analyzing, and reporting these transactions to oversight agencies, regulators, and tax collection entities.
   - The financial statements used in accounting are a concise summary of financial transactions over an accounting period, summarizing a company's operations, financial position, and cash flows.
3. Define Programmer.

   Ans:- a person who writes code for computer programs. a person who programs a machine, device, or apparatus. a person who prepares program schedules, as for radio or television. a person who prepares instructional programs.
4. Define feasibility study.

   A feasibility study is an analysis that considers all of a project's relevant factors—including economic, technical, legal, and scheduling considerations—to ascertain the likelihood of completing the project successfully
5. Name Four Major Vendors of Computer Hardware.[2020(w)][2017(S)][2018(S)][2019][2016]

   ANS:- HP,DEL, IBM,HCL etc

Long Question

1. Discuss the type of job carried out in computer in an organization.
2. Describe need of management in computer centers and state different types of job carried out in computer organizations.[2020(w)].[2018(w)]
3. Explain the duties and responsibility of personal involved in computer center management.[2017(S)]
4. Explain the different hierarchical position of different level of management.
5. What is the need of computer center ? write the steps how a computer center is established.[2019][2016].

CHAPTER-2

SITE PREPARATION & INSTALLATION

2.1LAYOUTS OF COMPUTER CENTRE
2.2 FALSE ROOFING, AIR CONDITIONING, DUST PROOFING
FALSE ROOFING:
2.3 POWER CONDITIONING EQUIPMENTS LIKE CVT, UPS, ISOLATION CIRCUITS
CVT-CONSTANT VOLTAGE TRANSFORMER

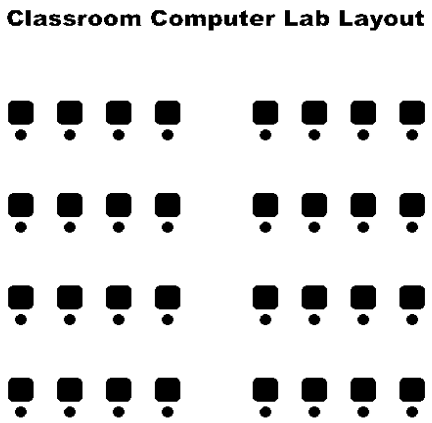
2.1LAYOUTS OF COMPUTER CENTRE

- Computer labs are more than just rooms with lots of computers.
- Care must be takento ensure that the lab is easy to access and fulfils its purpose.
- Learn about the fourmost popular computer laboratory layouts and designs used in High Schools and universities.
- Many high schools and colleges use computer labs to allow student access to the software necessary to complete coursework.
- Computer labs are also used to instruct students on computer use, programming, and related subjects.
- However, many institutions give little thought to the design and layout of the lab. Too often, they simply fill a room with computers and set up the machines any waythey fit inside the room.

Why computer lab design and layout is important:

- Computer labs must be designed intelligently and serve the purpose they wereintended to serve.
- Imagine if parking lots did not have lines telling you whereto park and everyone just drove in and parked wherever they wanted. Soon no one would be able to enter to exit.
- The lines in parking lots create important rules about how you should park in the lot.
- Similarly, the design and layout of a computer lab creates rules and defines how the lab can be used.
- Thought given to the layout of a computer lab dictates the usefulness of the lab and increases user satisfaction which justifies its expense and assists in future investments in upgrades.
- Certainly, the layout of the lab depends on the equipment, the furniture, andspace available.
- The purpose of this document is to discuss some basic computer lab layouts and their advantages and disadvantages.
- Any of these layouts can be modified to satisfy the individual needs of the institution.
- It just takes a little planning and imagination to adapt any of thesedesigns to a specific application.

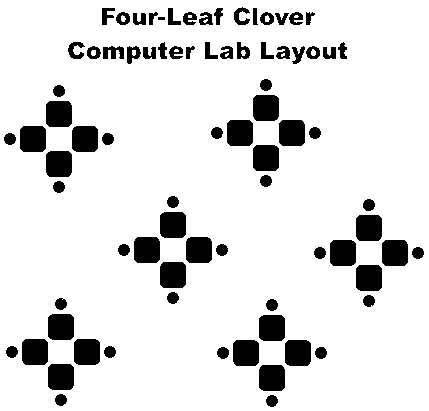
Classroom Computer Lab Design:



- The classic classroom computer lab design serves as the default layout in many High School and Colleges.However, it does have two major advantages.
- First,it serves as a great instruction room where studentslearn computer topics from an instructor at the frontof the room.
- With everyone facing the same direction, it allows instructors to see the faces of thestudents with which to read non-verbal cues as to whether students are learning the material or need more help.
- Second, it is similar to the layout of other classroom environment emphasizing that the students are there to learn.
- One disadvantage of the classroom layout is the need to disturb otherstudents along the rows of computers as students enter and exit the lab.

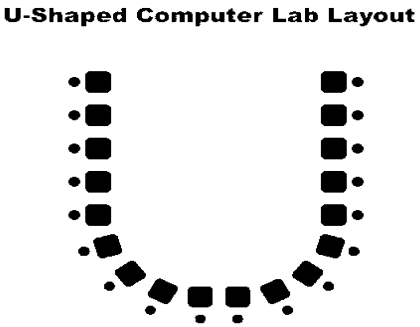
- For labs where students are coming and going, the classroom layout is not ideal. In addition,the classroom layout is not conducive to team work.
- It is difficult for students to work together, especially on collective projects and in peer-assist teaching models.

Four-Leaf Clover Computer Lab Layouts:



- The four-leaf clover design offers the most privacy for students and reduces to a minimum the possibility of cheating during tests or exercises.
- It also eliminates the need for students to disturb others when entering and exiting the lab and allowsinstructors to go from student to student to addressindividual problems and concerns.
- One disadvantage of the four-leaf clover design has to do with attention spans. When students are sitting at their own computers, instructors will not be able to see whateach student is doing at his/her workstation.
- Students may not be paying attentionto lessons or may be surfing to inappropriate websites in labs equipped with Internetaccess.
- Four-leaf clover designs can also be more expensive if each computer sits on its own table.
- Some computer lab furniture is made specifically for this design offering space for four computers on one table or desk.

U-Shaped Computer Lab Designs:



- The U-shaped computer lab layout encourages engagement between instructors and students.
- Instructors can enter the U and engage with students one-on-one. This design also serves as themost conducive layout for computer maintenance as technicians do not have to disturb others to gainaccess to the computers.
- In addition, students will not interfere with other students' work while entering and exiting the lab. Unfortunately, the U-shaped design offers little opportunity for instructors to monitor what students are doing and looking at on their monitors.
- This design is notcompatible with test taking and requires many assistants to monitor students. Furthermore, this design often takes up more space that other layouts.

Inverted U-Shaped Computer Lab Layouts

- Like the U-shaped layout, the Inverted U-shape also offers engagement between instructors and students.
- In addition, the layout allows for the most convenient method of monitoring students.
- For individual learning, this layout minimizes the distance instructors must walk to move from workstation to workstation and student to student.
- Like the classroom layout, traffic into and out of the Inverted U-shape can become constrictive especially when all of the students must enter and exit at thesame time.
- This congestion is reduced if students are entering and exiting individually as in an open lab paradigm where students can come and go as they please.
- In addition, this layout takes up the same amount of space as the U-shapeddesign. If space is not a consideration, either of the U-shaped layouts is appropriate.

2.2 FALSE ROOFING, AIR CONDITIONING, DUST PROOFING

FALSE ROOFING:

- False ceiling provides tidiness and aesthetic effect to the computer room. It also serves as a plenum for lighting fixtures.
- The ceiling plate ispreferred to be of easy remove and install type for the access of utilities in the ceiling void.
- Non-combustible and dust-free plates are required.
- If false ceiling is infeasible. false ceilings provide good acoustics where required sounds can be enhanced and at the same time unwanted sounds can be minimized.
- They provide space for housing electric wires, pipes, and air-conditioning ducts.
- False ceilings can reflect and diffuse light obviating the need for unnecessary artificial lighting thus lowering energy consumption. These ceiling panels offer fire safety andmoisture resistance features as well.
- False ceilings can be of different types basedon their applications. These ceiling tiles use different materials to provide various kinds of features.

AIR CONDITIONING:

- Though individual computer systems are typically equipped with cooling systems, the systems are built to service a single unit in adequate space.
- This is very much not how most computer rooms are laid out, and each addedmachine drastically increases the heat.
- This is why computer room dedicated AC systems are so vital! Standard structure-wide cooling systems fail to suit your needs,and thus cannot be trusted to protect your investment.
- The two H’s that can hurt computer operations: Heat & Humidity

Heat:

- Has your computer ever operated at an annoyingly slow rate or randomly shutdown when you are in the middle of an important work-related task? A computer working at a glacial pace or shutting down unexpectedly could be the result of overheating.
- Such technological events can slow down business or bring it to a haltaltogether, which will not make a business owner or employees happy.
- Theelectronic components inside a computer have a limited thermal tolerance.
- The CPU, the most power consuming unit of the computer, is the most vulnerable to overheating.
- The computer's motherboard, which provides for communication among the different electronic components, has a temperature sensor and will instruct the CPU and other components such as the hard drive to slow down or shutdown if overheating continues.

Humidity:

- As we've learned in an elementary first aid or science class or through an unfortunate first-hand experience, water and electricity don't mix. When they do it can yield painful results.
- Computer components exposed to extreme humidityon a consistent basis can corrode and eventually break down.
- If high humidity insideyour computer produces condensation, your computer could short-circuit.
- If your computer short-circuits, you could lose data and damage could occur to some computer components. Humidity levels should be kept between 45 and 60-percent, which should be easily attainable if you have a properly designed and maintained computer room air conditioning.

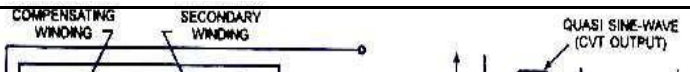
Dust Proofing:

- Too much dust generally blocks the air circulation inside the CPU insulating all thecomponents if gets accumulated for longer periods of time creating a layer above. If the environment is dusty, the computers should be regularly serviced to get rid of harmful dust.
- The service should include; blowing dust from the System unit, cleaning the floppy drives, cleaning the Keyboard, cleaning the Monitor externally,and also cleaning all peripheral devices such as Printers and Mouse.
- Set up the computer laboratory in a location away from excessive dust. Remove your shoes before you enter the computer room to prevent dust. The computer room should befitted with special curtains that would reduce entry of dust particles.
- The floor should be covered with Carpets in order to absorb dust, and also absorb the noise made by chairs. Cover the computer devices with Dust covers when not in use or when cleaning the computer room.

2.3 POWER CONDITIONING EQUIPMENTS LIKE CVT, UPS, ISOLATION CIRCUITS

CVT-CONSTANT VOLTAGE TRANSFORMER:

- The reason we use a CVT and not a voltage stabilizer for computer applications is that in the voltage stabilizer relays are present and when these relays operate (switch), the output voltage may be interrupted for a short time. Such a transient may not be desirable for computers which may cause the computer to reboot. Also, the CVT provides a clean spike-freeoutput voltage. The voltage regulation possible in a CVT also is good.
- The CVT is simply a



magnetic transformer of a special construction that has a capacitor connected across the secondary winding of the transformer.

- In an ordinary transformer, the primary and secondary windings are wound near each other so that whenever there is a change of voltage across theprimary there is a corresponding change in the secondary voltage depending upon the ratio of the turns on the two windings.
- However, in a CVT the primary and secondary windings are wound separately from each other, as illustrated in figure.To set up field in between the coils, a separate shunt path is provided between the two windings but an airgap is formed in the shunt path.
- A capacitor is connected across suitable tapings of the secondary winding. The portion of the magnetic coreover which the secondary winding is wound is saturated, while the portion over which the primary is wound is not saturated.
- A capacitor is connected across the secondary winding to tune out the output at a fre-quency very close to 50 Hz. Thiscapacitor also makes the current in the secondary winding to increase which helps in the saturation of the secondary flux.
- Since the secondary ac flux is restricted toa saturated value for a large range of the input voltage (170-270 V), a constant voltage is available across the secondary winding. The output voltage will not be of a pure sinusoidal waveform but will be an approximate sinewave with the peaks flat-tened approaching a square wave.
- A compensating winding is shown connected in series to the secondary to improve the CVT performance.

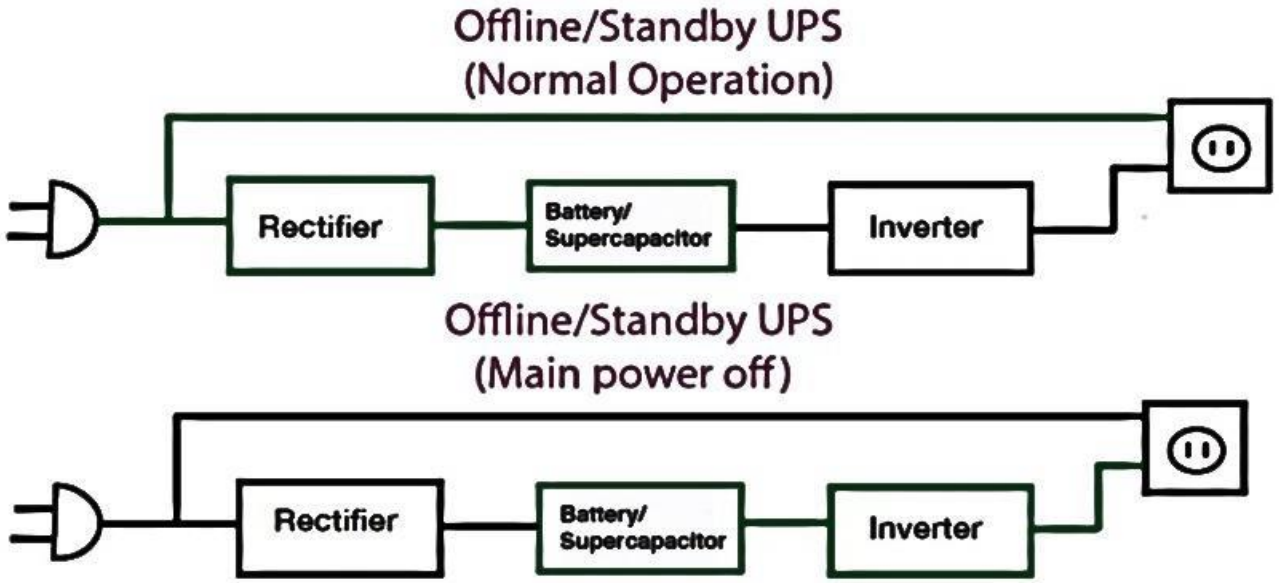
UPS (UNINTERRUPTIBLE POWER SUPPLY):

- The purpose of a UPS is to provide emergency power (usually by a lead/acid battery) to a load when it senses that theinput power source has failed.
- They are different from emergency power systems or standby generators because they provide near-instantaneous protection from power interruption by using a battery (which can be a supercapacitor or flywheel).
- The battery itself usually has a short runtime (about 5-20 minutes), but it should beenough to either save all that precious data/progress that you have made, gracefullyshut everything down, or fix the problem that caused the outage.
- A UPS can be usedto protect hardware like data centers, computers, and other electrical equipment where an unexpected surge/sag can cause serious problems like data loss, businessdisruption, and even injuries or fatalities.

- There are three types of uninterruptiblepower supplies: static, dynamic (rotary), and hybrid. Static uses power electronic converters, dynamic uses electromagnetic engines (generators and motor), and hybrid uses a combination of both static and dynamic.

Offline/Standby Uninterruptible Power Supply:

- The offline/standby UPS is the most basic out of the three. It provides light surge protection and battery back-up.During normal operations, it gets its power from its main power source (generally an AC outlet).
- Once it senses that the main power source goes beyond acceptable limits or fails, it switches to the "offline/standby" battery where it will then go tothe DC/AC inverter – as such, there will be a small transfer time between the mainpower source and battery.



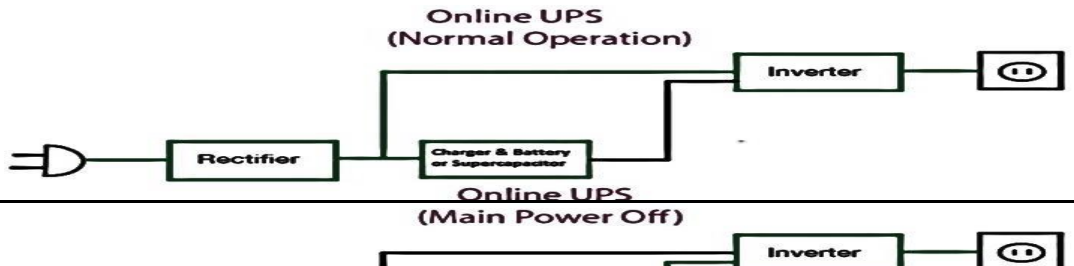
What's usually in a standby/offline uninterruptible power supply?

Most standby/offline UPS have a switch to either run on the main power source or the battery component.

- The majority of the bulk is in the battery component, as the main power supply goes to the AC/DC rectifier that charges the battery. After that it goes into a DC/AC inverter to output into the load.

Online/Double Conversion Uninterruptible Power Supply:

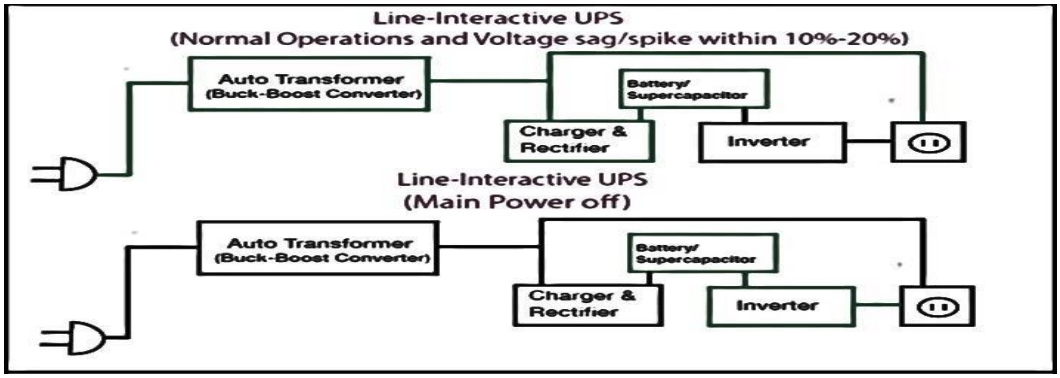
- The online/doubleconversion UPS differs from the offline/standby as the DC/AC inverter is always connected on.
- This means there will be no transfer time between the main power source and battery, providing greater protection against spikes, sags, electrical noise, and complete power failure.



What's usually in an online/double conversion uninterruptible power supply? The main power source in double conversion UPS goes into the AC/DC rectifier evenduring normal operations, so it must go through a DC/AC inverter every time, hencethe term "double conversion."

Line-Interactive Uninterruptible Power Supply:

- The line-interactive UPS has a similar design to the offline/standby, but with properties of an online/double conversion as well.
- The line-interactive design can handle small under-voltages andover-voltages (about 20% from its standard voltage) by using a multi-tap variable voltage autotransformer or buck-boost converter.
- Even during this small under/over E voltages, the battery is not being used and is still being charged until there is a big under/over-voltage.



ISOLATION CIRCUITS:

- Isolation is the electrical or magnetic separation between twocircuits and often used to separate two distinct sections of a power supply. Isolationprovides a barrier across which dangerous voltages cannot pass in the event of a fault or component failure.
- This barrier ensures that the electrical equipment is safe by preventing electric shock and fire hazards. The power supply isolation alsobreaks the ground loops and thereby eliminating noise in the electrical systems.

Reasons for isolation in electrical equipment:

- Safety: to protect the operator from dangerous voltages
- Voltage level shifting
- To provide galvanic isolation in which the two isolated circuits communicate without a direct conduction path.
- Prevent ground loops.
- The isolation protects the equipment from the line-level events such as surges, lightning strikes, etc.

The three commonly used methods for isolation are:

Physical Isolation:

- Physical power supply isolation using a media such as insulation,a dielectric medium, air gap or any other non-conductive path between conductor surfaces. This is the most basic isolation method that prevents any electrical or magnetic interaction.

Transformer:

It provides isolation through magnetically coupling the primary side tothe secondary winding. In addition to the isolation, a transformer provides other functions such as, voltage step-down or step-up, multiple outputs or voltage level translation.

Opt couplers:

- The isolation is provided by an air gap and the signal is transferred through the using light. The two major types in this category are:

IC package: It consists of a light emitting and a light receiving semiconductor devicein one package. These are commonly used in the feedback circuit from thesecondary to primary across the supply's isolation boundary. These can handle isolation voltages in the order of 3 KV.

Optical Fibres:

- These are used for high voltage supplies in tens or hundreds of Kilovolts isolation in addition to control and data signals transmission.

Short question

1. **Define UPS.[2019(s)]**

Ans:- An uninterruptible power supply (UPS) is a device that allows a computer to keep running for at least a short time when the primary power source is lost. UPS devices also provide protection from power surges.

2. **What is CVT?**

Ans:-Constant voltage transformer is a transformer engineered to operate in a condition of constant core saturation, meaning its iron core is stuffed with magnetic lines of flux for a large portion of the AC cycle so that variations in supply voltage have little effect on the core's magnetic flux density.

3. **Define Physical Isolation:**

Ans:- Physical power supply isolation using a media such as insulation,a dielectric medium, air gap or any other non-conductive path between conductor surfaces. This is the most basic isolation method that prevents any electrical or magnetic interaction.

Long question

1. Explain the use of computer in small and medium scale industry.
2. How different industries are classified as per their computer requirements?[2019(s)]
3. State how the industries are categorical and explain how their computer requirements are assess.[2017(s).
4. What is layout of a computer center? write the factors taken into account while layout planning is made .[2016(s)]

CHAPTER -3
MOTHER BOARD and COMPONENTS

3.1 COMPONENT S AND SLOT S:
3.2 MO THERBO ARD A RCH ITE CTURE AND BL OCK DIAGRAM
3.3 PRO CES SO R S OR CPU
3.4 CHI P SETS
3.6 CO LO UR CO D ES F OR DEV ICES/PO RTS
3.5 BUS STANDARDS

3.1 COMPONENTS AND SLOTS:

PROCESSOR SOCKET/SLOT:

- The CPU socket is rarely mentioned because it doesn't help or hinder performance. Rather, it provides a standardized shape for a specific generation of CPUs. Why, then, should you care about CPU sockets? Well, if you want to upgrade your CPU, you need to know the socket type.
- Your motherboard socket type dictates which type of CPU you can use, whether your CPU upgrade is worthwhile, or if you should consider upgrading your entire system.
- CPU socket is like a light socket. A light socket makes your light bulb part of an electrical network, giving the bulb the power, it needs to work.
- Your CPU socket makes a processor part of your computer, providing power and offering a way for the CPU to communicate with the rest of your system hardware.
- Unlike a light socket, CPU socket design does change frequently. Why? Well, changes to the CPU architecture are the reason.
- New processor architectures arrive every few years and often come with a new set of requirements, including shape, size, and motherboard compatibility. Plus, there are two major x86 processor manufacturers: AMD and Intel. AMD and Intel CPUs have separate processor architectures, and compatibility between the two is impossible.

PGA Socket:

- A pin grid array (PGA) socket is usually a square package made up of several holes in an array.
- The CPU itself has the pins that insert into the socket.
- The arrangement of pins on the CPU must correspond to the slots on the socket; if not, the CPU will not connect properly to the board.
- To secure a CPU into a PGA socket, you must press down until spring contacts lock it

-- however, if you do not line up the pins properly, you may bend or damage them.

ZIF Socket:

- A zero insertion force (ZIF) socket is an extension of a PGA socket, with pins on the CPU.
- With a ZIF socket, you don't have to press down on the CPU to lock it in place. Instead, you simply place the CPU into the socket, then lock it in using a lever or slider on the side of the socket.
- This results in less risk of you damaging the CPU when you try to insert or remove it from the socket.

LGA Socket:

- A land grid array (LGA) socket is essentially the opposite of a PGA socket. Instead of having the pins connected to the CPU, they're connected to the socket itself while the CPU has slots with connectors.
- To lock a CPU into an LGA socket, you must line up the pins and apply a small amount of pressure.
- LGA sockets are less fragile overall than PGA sockets, and you can also solder down the package using surface mount technology.

BGA Socket:

- A ball grid array (BGA) is another variant on the PGA socket -- but instead of pins, a BGA socket has copper pads which that are soldered to the package.
- This means that you do not have to worry about damaging any of several hundred pins, especially as pin-chip architecture designs CPUs with pins closer and closer together.
- This also means there's less distance for data to travel, so there's less of a chance that the signals will distort.

MEMORY SOCKETS:

- When you talk about the Random Access Memory (RAM) of your device, you're actually talking about two parts – your RAM module and your RAM slots.
- Each slot will fit a certain module to at, which means that certain types of modules just won't fit.

- To understand the different types of RAM slots, we need to look at what types of RAM modules exist and how they differ. Once you know that, it will be easy to figure out why RAM slots are also different from one another.
- RAM slot, socket, or a memory slot is a gap on your computer's motherboard where you can insert your RAM.
- Depending on the motherboard type, there might be up to four memory sockets. If you have a high-tier motherboard, you can even have more. There are three most common types of RAM:
- **SDRAM (Synchronous DRAM):** A type of memory that synchronizes using the system clock of your computer.
- **DDR (Double Data Rate):** Uses both the rising and falling edge of the clock, which can double the computer's memory. You'll find the latest version of the DDR technology on the newest video and memory cards.
- **DIMM (Dual In-Line Memory Module):** This module contains a circuit board and an additional RAM chip. SO-DIMMs are the newest version of the DIMM and are usually part of laptop computers.

Throughout the history of RAM, the physical shape of the modules has changed. These physical modifications are what made the modules faster. At the same time, the changes impacted the look of RAM sockets too.

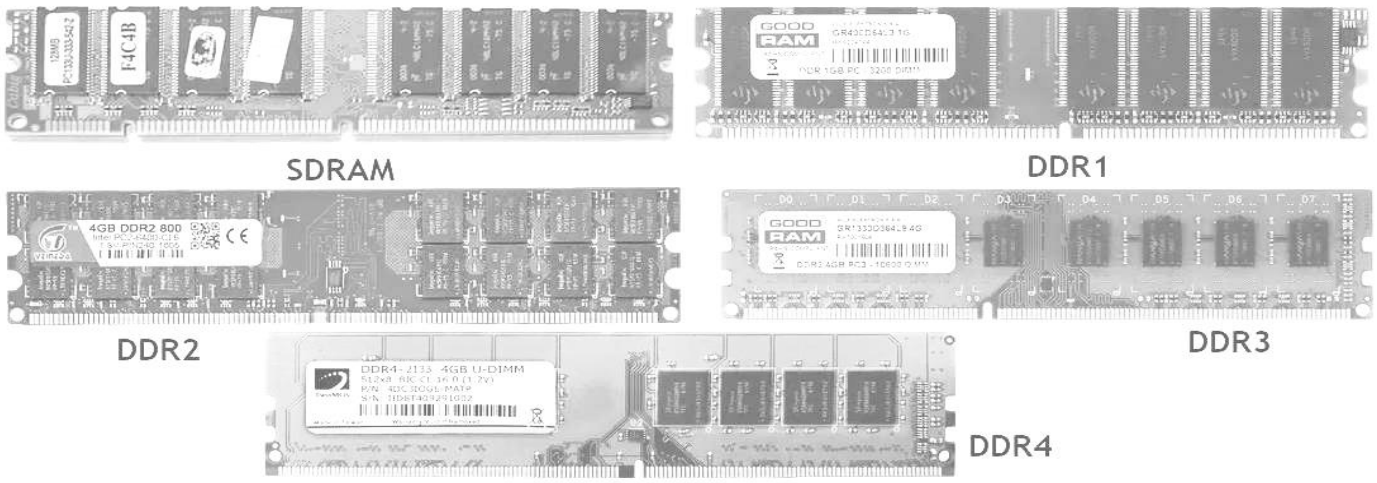
Some of the changes include:

- A different number of pins – Newer RAM modules have a higher number of pins than the older ones. That is why you can't insert newer RAM modules into older sockets.
- The different gap between pins Keyway slots are in different locations in the connector space
- Different height and length – The length is more problematic since it either fits in the RAM socket or it doesn't. The height may vary even among the same module types because it doesn't have to fit anywhere.
- Indents and shapes – Newer modules have an indent on their edges so you can take them out easily, and their shape also varies depending on the version.

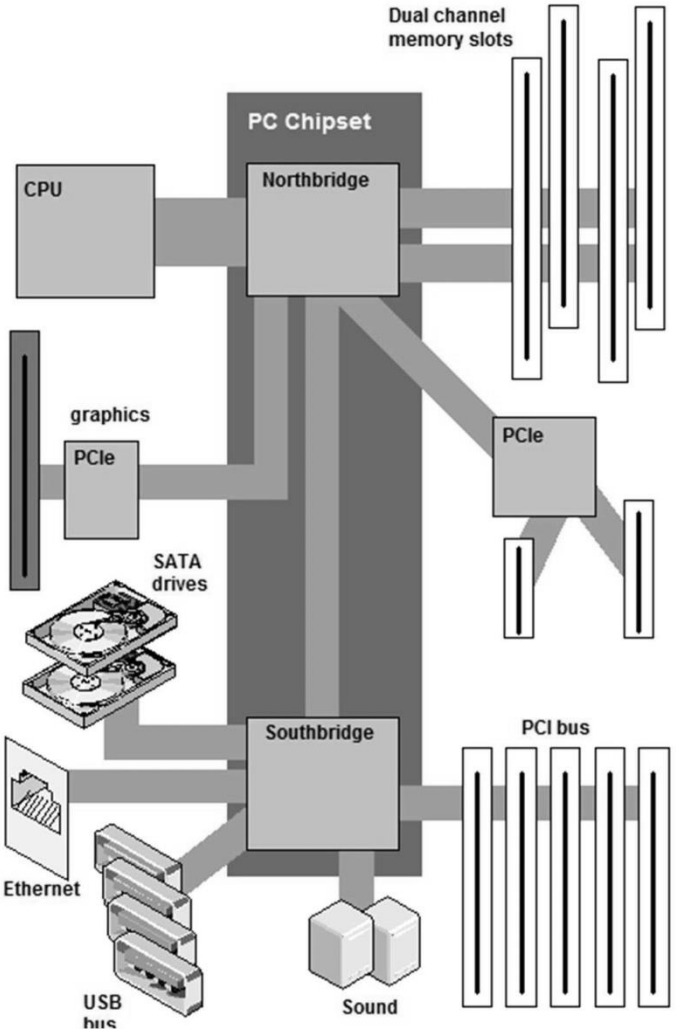
There are various RAM slots depending on the module. Let's start from the beginning:

- **SDRAM:** This module had a 64-bit bus and needed 3.3V to work. What's important is that it had 168 pins DIMM, so the SDRAM slot had 168 empty pin sockets.
- **DDR1:** The first double data rate memory had 184 pins. It was popular from the late 20th century to 2005. Its maximum capacity was 1GB, and it went into the AMD Socket A and 939, Intel Socket 478 and LGA 775, and Socket 756.
- **DDR2:** This module has 240 pins per DIMM and a capacity of up to 4GB. It replaced DDR 1 in 2005 and was popular for a few years. It supported the Intel LGA 775 and the AMD Socket AM2.
- **DDR3:** Physically, this module has a similar shape to its predecessor. It has 240 pins, but a higher frequency range and a capacity of up to 8GB. The RAM sockets that can support it include the LGA 775, 1150, 1151, 1155, 1156, and 2011, as well as the AMD AM1, 3, 3+, FM1, FM2, and FM2+.
- **DDR4:** The fourth generation has 288 pins and can go up to 16GB. It is currently on the high-end of the spectrum and is compatible with the Intel LGA 2011- E3, 1151, and AMD AM4 sockets.

Although the RAM slots are the last thing that comes to your mind when you're purchasing your computer, it would be good to check that out too. Sometimes a motherboard can be a bit older, meaning that you can't plug in the latest RAM modules in it. However, the more important thing you should look at is the capability of your motherboard. If it's in the mid-tier or low-tier, chances are that the slots will support older versions of RAM modules.



CHIP SETS:



- A set of chips that provides the interfaces between all of the PC's subsystems.
- It provides the buses and electronics to allow the CPU, memory and input/output devices to interact.
- PC chipsets, which are housed on one to four chips, include built-in controllers for almost all common peripherals.
- The primary components on a PC motherboard are the PC chipset, CPU, memory, clock, buses and BIOS.
- The chipset is the "glue" that connects the microprocessor to the rest of the motherboard and therefore to the rest of the computer.
- On a PC, it consists of two basic parts -- the

northbridge and the southbridge.

All of the various components of the computer communicate with the CPU through the chipset.

The northbridge connects directly to the processor via the front side bus (FSB).

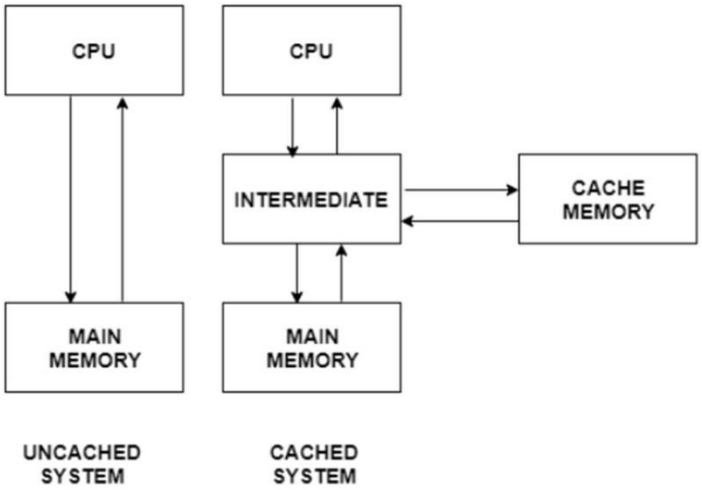
- A memory controller is located on the northbridge, which gives the CPU fast access to the memory.
- The northbridge also connects to the AGP or PCI Express bus and to the memory itself.

- The southbridge is slower than the northbridge, and information from the CPU has to go through the northbridge before reaching the southbridge.

- Other busses connect the southbridge to the PCI bus, the USB ports and the IDE or SATA hard disk connections.
- Chipset selection and CPU selection go hand in hand, because manufacturers optimize chipsets to work with specific CPUs.
- The chipset is an integrated part of the motherboard, so it cannot be removed or upgraded.
- This means that not only must the motherboard's socket fit the CPU, the motherboard's chipset must work optimally with the CPU.

CACHE:

- Cache is a type of memory that is used to increase the speed of data access. Normally, the data required for any process resides in the main memory.
- However, it is transferred to the cache memory temporarily if it is used frequently enough. The process of storing and accessing data from a cache is known as caching.
- In an uncached system, there is no cache memory. So, all the data required by the processor during execution is obtained from main memory. This is a comparatively time consuming process.
- In contrast to this, a cached system contains a cache memory.



Any data required by the processor is searched in the cache memory first. If it is not available there then main memory is searched. The cache system yields faster results than the uncached system because cache is much faster than main memory.

Some of the advantages of cache memory are as follows −

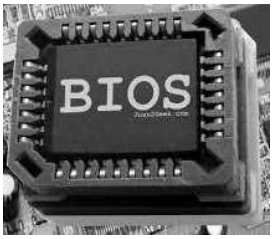
- Cache memory is faster than main memory as it is located on the processor chip itself. Its speed is comparable to the processor registers and so frequently required data is stored in the cache memory.
- The memory access time is considerably less for cache memory as it is quite fast. This leads to faster execution of any process.
- The cache memory can store data temporarily as long as it is frequently required.

After the use of any data has ended, it can be removed from the cache and replaced by new data from the main memory.

Some of the disadvantages of cache memory are as follows −

- Since the cache memory is quite fast, it is extremely useful in any computer system. However, it is also quite expensive and so is used judiciously.
- The cache is memory expensive as observed from the previous point. Also, it is located directly on the processor chip. Because of these reasons, it has a limited capacity and is much smaller than main memory.

BIOS:



- Short for Basic Input/Output System, the BIOS is a ROM chip found on motherboards that allows you to access and set up your computer system at the most basic level.

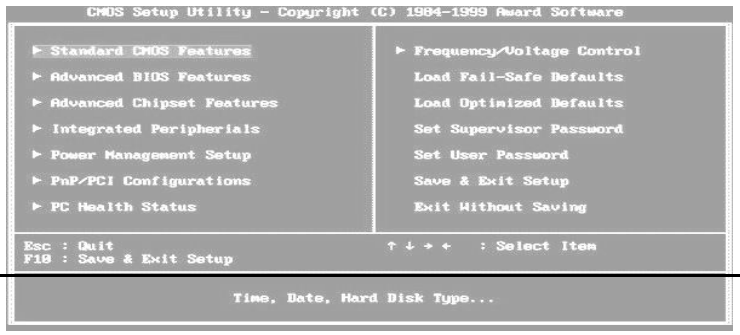
motherboard.

- The BIOS includes instructions on how to load basic computer hardware. It also includes a test referred to as a POST (Power-On Self-Test) that helps verify the computer meets requirements to boot up properly.
- If the computer does not pass the POST, you will receive a combination of beeps indicating what is malfunctioning in the computer.

The four main functions of a PC BIOS:

- **POST -** Test the computer hardware and make sure no errors exist before loading the operating system. Additional information on the POST is available on our POST and beep codes page.
- **Bootstrap Loader -** Locate the operating system. If a capable operating system is located, the BIOS will pass control to it.
- **BIOS drivers -** Low-level drivers that give the computer basic operational control over your computer's hardware.
- **BIOS setup or CMOS setup -** Configuration program that allows you to configure hardware settings including system settings such as computer passwords, time, and date.

Adding additional memory to a BIOS chip, as an upgrade, can only be done by physically removing it from the motherboard and replacing it with a



new, more advanced BIOS chip.

- The data on a BIOS chip can be updated if it's a flash BIOS. Using specially designed software, the BIOS can be updated to fix problems or add new features for the motherboard.
- To determine the type of version of BIOS on your computer, you need to access the BIOS setup. On the main BIOS screen, it should display the BIOS type, like AMI, Award, or Phoenix, and the version of the BIOS.

CLOCK GENERATOR:

- A clock generator is an electronic oscillator (circuit) that produces a clock signal for use in synchronizing a circuit's operation.
- The signal can range from a simple symmetrical square wave to more complex arrangements.
- The basic parts that all clock generators share are a resonant circuit and an amplifier.
- The resonant circuit is usually a quartz piezo-electric oscillator, although simpler tank circuits and even RC circuits may be used.
- The amplifier circuit usually inverts the signal from the oscillator and feeds a portion back into the oscillator to maintain oscillation.

RTC:

A real-time clock (RTC) is a computer clock (most often in the form of an integrated circuit) that keeps track of the current time. Although keeping time can be done without an RTC, using one has benefits:

- Frees the main system for time-critical tasks.
- Sometimes more accurate than other methods.
- **I/O CONTROLLER:**
- I/O controllers are a series of microchips which help in the communication of data between the central processing unit and the motherboard.
- The main purpose of this system is to help in the interaction of peripheral devices with the control units (CUs).

POWER CONNECTORS: All computer power supply connectors have a fool proof design such that they can only be connected in a single direction (so there's no way to mess up here).

(20+4 Pin) ATX Power Connector: The primary task of the Power Supply Unit (PSU) is to provide your motherboard with power.

- This is done via the 20-pins or 24-pins connector.

A 24-pins cable is backwards compatible with a 20-pins motherboard, often this cable can be split into 20- and 4-pins (like in the image above).

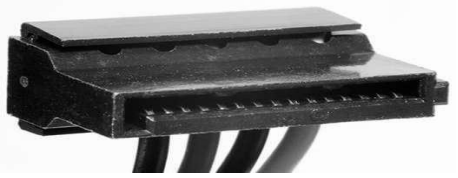
P4 (EPS Connector): At some point in time the motherboard's pins were no longer sufficient to provide the processor (cpu) with power. With overclocked cpu's drawing as much as 200W a need to provide power directly to the CPU was created.

PCI-E Connector (6-pin en 6+2 pin): The motherboard can provide a maximum of 75W through its PCI-E interface slot.

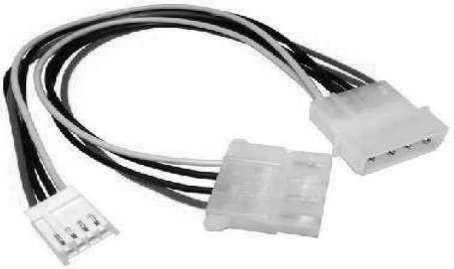
- Faster dedicated graphics cards require much more power. To solve that issue the PCI-E connector was introduced.
- The PCI-E 6-pin connector can supply an additional 75W per cable.

Molex (4 Pin Peripheral Connector): Molex connectors have been around for a very long time and can deliver 5V (red) or 12V (Yellow) to hardware peripherals.

SATA Connector: The SATA connector is the guy that made the Molex obsolete. All modern DVD-players, hard disk drives and SSD's are powered by SATA power.



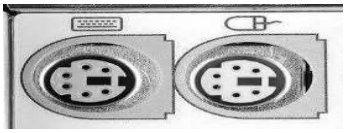
Mini-Molex / Floppy connector: Completely obsolete, but some PSU's still come with a mini- molex connector.



Basically they were superseded by the USB stick. **Adapter: Molex to SATA Power cable:** Old power supply unit or simply lacking the required number of SATA power connectors? Use a Molex to SATA connector to power your latest hard disk drive.

Adapter: Molex to PCI-E 6-pins: Need another PCI-6 pin cable to power your graphics card? Use the "2x Molex to 1x PCI-E 6-pin" adapter.

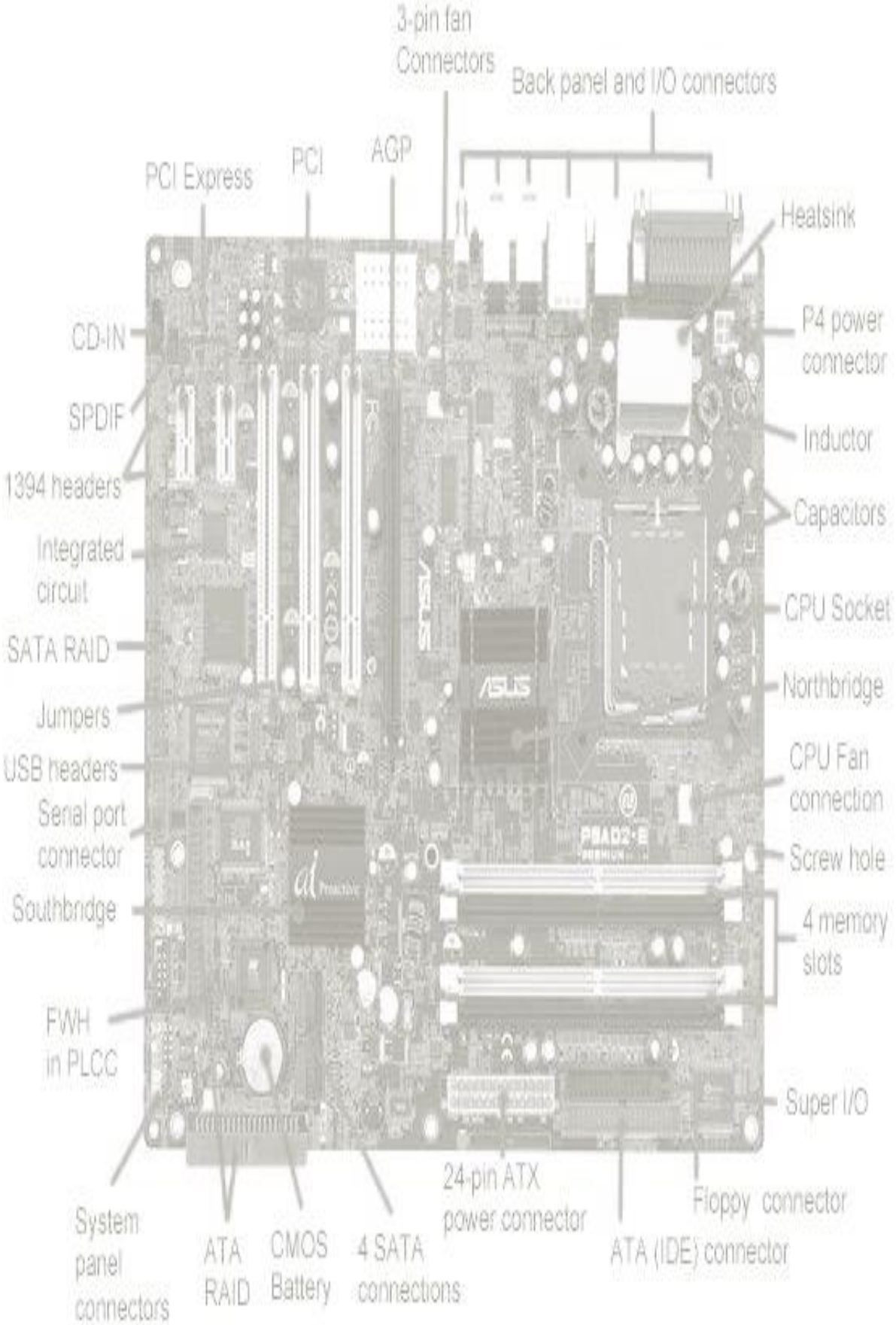
<u>KEYBOARD/MOUSE CONNECTORS:</u> Mouse and keyboard connectors are called Mini-DIN connectors.



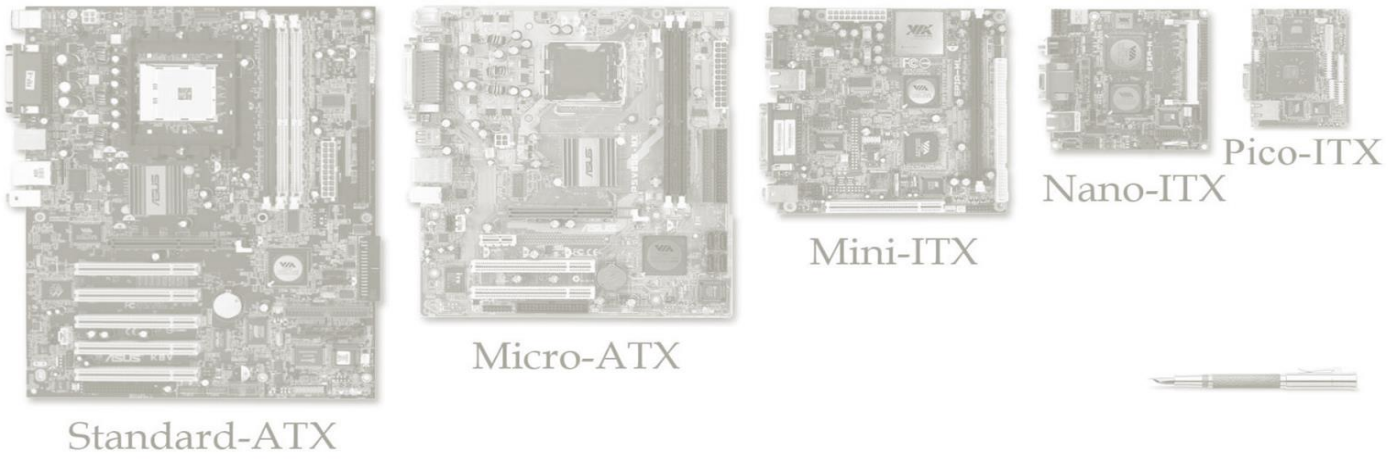
- They are also often called PS/2 because these were the type of ports IBM invented for their PS/2 line of computers.
- The green Mini-DIN is used to connect the mouse and the purple one is used to connect the keyboard.
- **<u>JUMPERS:</u>** In computing, the term jumper is used to refer to a short length of electrically conductive material used to connect two parts of a circuit together. They are very often used when setting up motherboards to bypass parts of a circuit that are not needed, or to close a break in a circuit.

3.2 MOTHERBOARD ARCHITECTURE AND BLOCK DIAGRAM:

- The motherboard is the main component, based on its function, of the internal structure of all computers.
- Mainly responsible for the interaction of all the elements of the computer, such as the CPU, RAM, storage, graphics card, I/O, among others.
- It is extremely important to recognize its capabilities, limitations as well as the main features it contains so as not to repress the potential of any other piece within the PC.
- Another key element is the form-factor (exterior physical size and shape) which also should be considered for the computer application according to the field where it'll be used.
- Motherboards are always characterized by their chipset, type of processor socket, and their form factor.
- The following Motherboard Components are:
- CPU and CPU socket.
- RAM, DRAM, and RAM slots.
- ATX power supply.
- IDE Connectors
- Northbridge and southbridge.
- AGP Slot
- PCI Slots.
- CMOS Backup Battery
- Integrated connectors for peripherals such as USB, mouse, keyboard, display, audio, Ethernet, etc.


3-pin fan Connectors
Back panel and I/O connectors
PCI Express
PCI
AGP
Heatsink
CD-IN
P4 power connector
SPDIF
Inductor
1394 headers
Capacitors
Integrated circuit
CPU Socket
SATA RAID
Northbridge
Jumpers
CPU Fan connection
USB headers
Serial port connector
Screw hole
Southbridge
4 memory slots
FWH in PLCC
Super I/O
24-pin ATX power connector
Floppy connector
System panel connectors
ATA RAID
CMOS Battery
4 SATA connections
ATA (IDE) connector

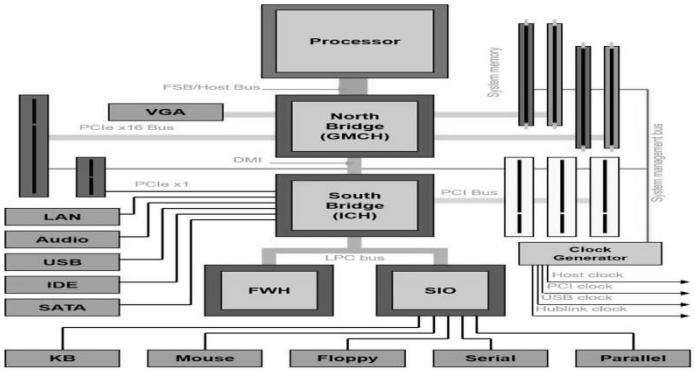
Types of Motherboard Form Factors:



Form Factor	Manufacturer/Date	Dimensions	Applications
Standard-ATX	Intel 1995	12 × 13 in	Workstation/Desktop
Micro-ATX	Intel 1997	9.6 × 9.6 in	Small Form Factor
Mini-ITX	VIA 2001	6.7 × 6.7 in	Small Form Factor
Nano-ITX	VIA 2003	4.7 × 4.7 in	Embedded Systems
Pico-ITX	VIA 2007	3.9 × 2.8 in	Embedded Systems
Mobile-ITX	VIA 2009	2.4 × 2.4 in	Embedded Systems

Working Principle:

A motherboard provides connectivity between the hardware components of a computer, like the processor (CPU), memory (RAM), hard drive, and video card.



- Each type of motherboard is designed to work with specific types of processors and memory, so they are not capable of working with every processor and type of memory. However, hard drives are mostly universal and work with the majority of motherboards, regardless of the type or brand.

Northbridge:

- Alternatively referred to as the PAC (PCI/AGP Controller) and nb, the Northbridge is an integrated circuit responsible for communications between the CPU interface, AGP, and the memory.
- Unlike the southbridge, the northbridge is directly connected to these components. It acts as a "bridge" for the southbridge chip to communicate with the CPU, RAM, and graphics controller.
- T h e northbridge 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 northbridge.

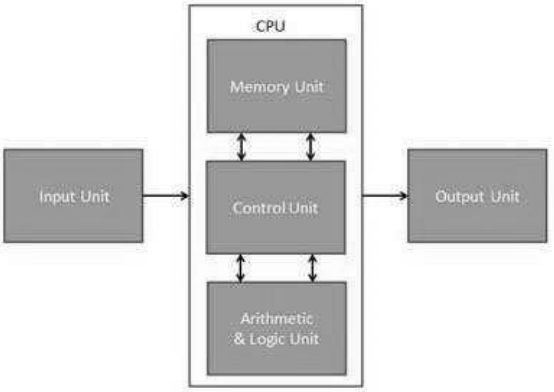
Southbridge:

- The southbridge is an IC on the motherboard responsible for the hard drive controller, I/O controller and integrated hardware. Integrated hardware can include the sound card and video card if on the motherboard, USB, PCI, ISA, IDE, BIOS, and Ethernet.
- The southbridge gets its name for commonly being South of the PCI bus. Although the southbridge handles most of the I/O devices, less prominent input/output devices, such as a serial port, keyboard, and non-USB mouse are handled by the SIO (super input/output).

3.3 PROCESSORS OR CPU:

Central Processing Unit (CPU) consists of the following features −

- CPU is considered as the brain of the computer.
- CPU performs all types of data processing operations.
- It stores data, intermediate results, and instructions (program).
- It controls the operation of all parts of the computer.



CPU itself has following 3 components.

- Memory or Storage Unit
- Control Unit
- ALU (Arithmetic Logic Unit)

MEMORY OR STORAGE UNIT: This unit can store instructions, data, and intermediate results. This unit supplies information to other units of the computer when needed. It is also known as internal storage unit or the main memory or the primary storage or Random Access Memory (RAM).

- Its size affects speed, power, and capability. Primary and secondary memory are two types of memories in the computer. Functions of the memory unit are −
- It stores all the data and the instructions required for processing.
- It stores intermediate results of processing.
- It stores the final results of processing before these results are released to an output device.
- All inputs and outputs are transmitted through the main memory.

CONTROL UNIT: This unit controls the operations of all parts of the computer but does not carry out any data processing operations. Functions of this unit are −

- It is responsible for controlling the transfer of data and instructions.
- It manages and coordinates all the units of the computer.
- It obtains the instructions from the memory, interprets them, and directs the operation of the computer.
- It communicates with Input/Output devices for transfer of data or results from storage.
- It does not process or store data.

ALU (ARITHMETIC LOGIC UNIT):

This unit consists of two subsections namely:

- Arithmetic Section
- Logic Section

Arithmetic Section: Function of arithmetic section is to perform arithmetic operations like addition, subtraction, multiplication, and division. All complex operations are done by making repetitive use of the above operations.

Logic Section: Function of logic section is to perform logic operations such as comparing, selecting, matching, and merging of data.

CORE 2 DUO:

The majority of the desktop and mobile Core 2 processor variants are Core 2 Duo with two processor cores on a single Merom, Conroe, Allendale, Penryn, or Wolfdale chip.

CORE 2 QUAD:

Core 2 Quad processors are multi-chip modules consisting of two dies similar to those used in Core 2 Duo, forming a quad-core processor.

- This allows twice the performance of a dual-core processors at the same clock frequency in ideal conditions. Initially, all Core 2 Quad models were versions of Core 2 Duo desktop processors, Kentsfield derived from Conroe and Yorkfield from

Wolfdale, but later Penryn-QC was added as a high-end version of the mobile dual-core Penryn.

CORE I3:

Intel intended the Core i3 as the new low end of the performance processor line from Intel, following the retirement of the Core 2 brand.

- The first Core i3 processors were launched on January 7, 2010.
- The first Nehalem based Core i3 was Clarkdale- based, with an integrated GPU and two cores.
- The same processor is also available as Core i5 and Pentium, with slightly different configurations.
- The Core i3-3xxM processors are based on Arrandale, the mobile version of the Clarkdale desktop processor.

CORE I5

The first Core i5 using the Nehalem microarchitecture was introduced on September 8, 2009, as a mainstream variant of the earlier Core i7, the Lynnfield core.

- Lynnfield Core i5 processors have an 8 MB L3 cache, a DMI bus running at 2.5 GT/s and support for dual-channel DDR3-800/1066/1333 memory and have Hyper-threading disabled.

CORE I7:

Intel Core i7 as an Intel brand name applies to several families of desktop and laptop 64-bit x86-64 processors using the Nehalem, Westmere, Sandy Bridge, Ivy Bridge, Haswell, Broadwell, Skylake, and Kaby Lake microarchitectures.

- The Core i7 brand targets the business and high-end consumer markets for both desktop and laptop computers, and is distinguished from the Core i3 (entry-level consumer), Core i5 (mainstream consumer), and Xeon (server and workstation) brands.
- Intel introduced the Core i7 name with the Nehalem-based Bloomfield Quad-core processor in late 2008.
- In 2009 new Core i7 models based on the Lynnfield (Nehalem-based) desktop quad-core processor and the Clarksfield (Nehalem-based) quad-core mobile were added,

and models based on the Arrandale dual-core mobile processor (also Nehalem-based) were added in January 2010.

3.4 CHIP SETS:

- A chipset is a set of electronic components in an integrated circuit known as a "Data Flow Management System" that manages the data flow between the processor, memory and peripherals. It is usually found on the motherboard.
- Chipsets are usually designed to work with a specific family of microprocessors. Because it controls communications between the processor and external devices, the chipset plays a crucial role in determining system performance.
- In computing, the term chipset commonly refers to a set of specialized chips on a computer's motherboard or an expansion card.
- In personal computers, the first chipset for the IBM PC AT of 1984 was the NEAT chipset developed by Chips and Technologies for the Intel 80286 CPU.
- In home computers, game consoles and arcade-game hardware of the 1980s and 1990s, the term chipset was used for the custom audio and graphics chips.

3.5 BUS STANDARDS:

PCI:

- Stands for "Peripheral Component Interconnect." PCI is a hardware bus used for adding internal components to a desktop computer.

For example, a PCI card can be inserted into a PCI slot on a motherboard, providing additional I/O ports on the back of a computer.

- The PCI architecture, also known as "conventional PCI," was designed by Intel and introduced in 1992. Many desktop PCs from the early 1990s to the mid 2000s had room for two to five PCI cards.
- Each card required an open slot on the motherboard and a removable panel on the back of the system unit. Adding PCI cards was an easy way to upgrade a computer, since you could add a better video card, faster wired or wireless networking, or add new ports, like USB 2.0.

- faster and capable of handling more bandwidth than PCI.
- PCI-Express is a point-to- point system, which allows for better performance and might even make the manufacturing of motherboards cheaper.
- PCI-Express slots will also accept older PCI cards, which will help them become popular more quickly than they would if everyone's PCI components were suddenly useless. It's also scalable. A basic PCI- Express slot will be a 1x connection.
- This will provide enough bandwidth for high- speed Internet connections and other peripherals.

AGP:

- Stands for "Accelerated Graphics Port." AGP is a type of expansion slot designed specifically for graphics cards.
- It was developed in 1996 as an alternative to the PCI standard. Since the AGP interface provides a dedicated bus for graphics data, AGP cards are able to render graphics faster than comparable PCI graphics cards. Like PCI slots, AGP slots are built into a computer's motherboard.
- They have a similar form factor to PCI slots, but can only be used for graphics cards. Additionally, several AGP specifications exist, including AGP 1.0, 2.0, and 3.0, which each use a different voltage.
- Therefore, AGP cards must be compatible with the specification of the AGP slot they are installed in. Since AGP cards require an expansion slot, they can only be used in desktop computers.

USB:

- USB, short for Universal Serial Bus, is a standard type of connection for many different kinds of devices.
- Generally, USB refers to the types of cables and connectors used to connect these many types of external devices to computers.
- USB ports and cables are used to connect hardware such as printers, scanners, keyboards, mice, flash drives, external hard drives, joysticks, cameras, and more to

computers of all kinds, including desktops, tablets, laptops, netbooks, etc.

USB Versions: There have been several major USB standards, USB4 being the newest:

- **USB4:** Based on the Thunderbolt 3 specification, USB4 supports 40 Gbps (40,960 Mbps).
- **USB 3.2 Gen 2x2:** Also known as **USB 3.2**, compliant devices are able to transfer data at 20 Gbps (20,480 Mbps), called Superspeed+ USB dual-lane.
- **USB 3.2 Gen 2:** Previously called **USB 3.1**, compliant devices are able to transfer data at 10 Gbps (10,240 Mbps), called Superspeed+.
- **USB 3.2 Gen 1**: Previously called **USB 3.0**, compliant hardware can reach a maximum transmission rate of 5 Gbps (5,120 Mbps), called SuperSpeed USB.
- **USB 2.0:** USB 2.0 compliant devices can reach a maximum transmission rate of 480 Mbps, called High-Speed USB.
- **USB 1.1:** USB 1.1 devices can reach a maximum transmission rate of 12 Mbps, called Full Speed USB.

USB Connectors: A number of different USB connectors exist, all of which we describe below.

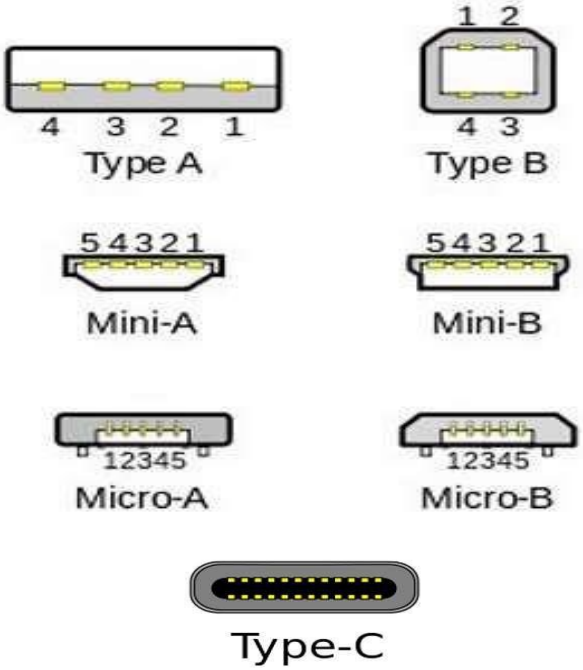
- **USB Type C:** Often referred to simply as USB-C, these plugs and receptacles are rectangular in shape with four rounded corners. Only USB 3.1 Type C plugs and receptacles (and thus cables) exist but adapters for backward compatibility with USB 3.0 and 2.0 connectors are available. This latest USB connector has finally solved the problem of which side goes up.
- Its symmetrical design allows it to be inserted in the receptacle in either fashion, so you never have to try again (One of the biggest peeves about earlier USB plugs) These are being widely adopted on smartphones and other devices.
- **USB Type A:** Officially called USB Standard-A, these plugs and receptacles are rectangular in shape and are the most commonly seen USB connectors. USB 1.1 Type A, USB 2.0 Type A and USB 3.0 Type A plugs and receptacles are physically compatible.
- **USB Type B:** Officially called USB Standard-B, these plugs and receptacles are square shaped with an extra notch on top, most noticeable on USB 3.0 Type B connectors. USB 1.1 Type B and USB 2.0 Type B plugs are physically compatible with USB 3.0 Type B receptacles but USB 3.0 Type B plugs are not compatible with USB 2.0 Type B or

USB 1.1 Type B receptacles. A USB Powered-B connector is also specified in the USB 3.0 standard. This receptacle is physically compatible with USB 1.1 and USB 2.0 Standard-B plugs, and of course, USB 3.0 Standard-B and Powered-B plugs as well.

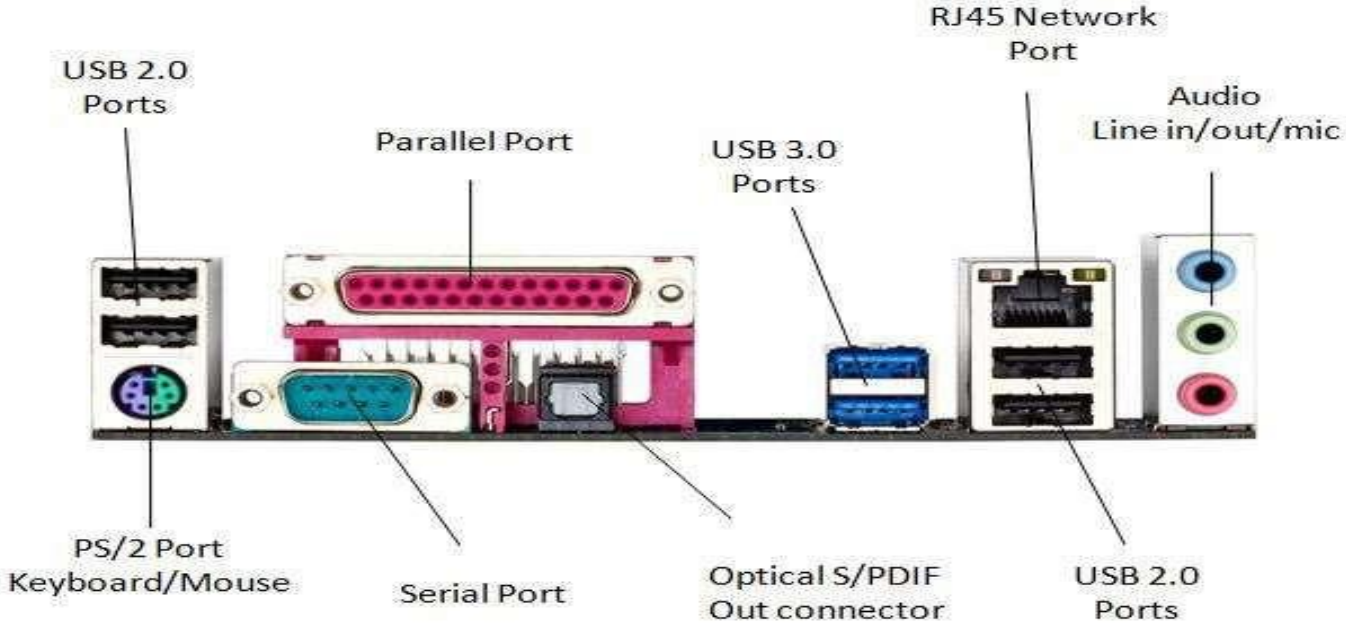
- **USB Micro-A:** USB 3.0 Micro-A plugs look like two different rectangular plugs fused together, one slightly longer than the other. USB 3.0 Micro-A plugs are only compatible with USB 3.0 Micro-AB receptacles.
- **USB 2.0 Micro-A:** plugs are very small and rectangular in shape, resembling in many ways a shrunken USB Type A plug. USB Micro-A plugs are physically compatible with both USB 2.0 and USB 3.0 Micro-AB receptacles.
- **USB Micro-B:** USB 3.0 Micro-B plugs look almost identical to USB 3.0 Micro-A plugs in that they appear as two individual, but connected, plugs. USB 3.0 Micro-B plugs are compatible with both USB 3.0 Micro-B receptacles and USB

3.0 Micro-AB receptacles. USB 2.0 Micro-B plugs are very small and rectangular but the two corners on one of the long sides are beveled. USB Micro-B plugs are physically compatible with both USB 2.0 Micro-B and Micro-AB receptacles, as well as USB 3.0 Micro-B and Micro-AB receptacles.

- **USB Mini-A:** The USB 2.0 Mini-A plug is rectangular in shape but one side is more rounded. USB Mini-A plugs are only compatible with USB Mini-AB receptacles. There is no USB 3.0 Mini-A connector.
- **USB Mini-B:** The USB 2.0 Mini-B plug is rectangular in shape with a small indention on either side, almost looking like a stretched out piece of bread when looking at it head-on. USB Mini-B plugs are physically compatible with both USB 2.0 Mini-B and Mini-AB receptacles. There is no USB 3.0 Mini-B connector.



3.6 COLOUR CODES FOR DEVICES/PORTS:



- A 3-row 15 hole female jack is for video (often color-coded blue). Usually, your video monitor has a cable that connects into that jack.
- There are other forms of video jacks, such as the DVI connector. The DVI has 3 rows, 24 pins, plus another square arrangements of 4 pins and a blade (which may be a cross-- it actually comes in more than three versions). DVI contains the same encoding as the HDMI connector used for digital TV connections. [HDMI uses a different connector, and contains audio as well as video.]

- Small round connectors are for the keyboard or the mouse (these are called PS2 connectors). Some mice are "serial mice" that plug into a serial jack. The keyboard connector is usually color-coded purple, the mouse connector is color-coded green.
- A 2-row female jack with 25 holes (one row with 12, the other with 13) is a parallel jack.
- The parallel jack is often color-coded magenta. A standard parallel cable plugs into that jack and has a "traffic island" jack that plugs into parallel devices, such as inkprint printers. A parallel port is also known as LPT1. If there is a second parallel port, it is called LPT2.

Short question

1. **Define AGP.**

   Stands for "Accelerated Graphics Port." AGP is a type of expansion slot designed specifically for graphics cards.

2. **Define USB.**

   USB, short for Universal Serial Bus, is a standard type of connection for many different kinds of devices. Generally, USB refers to the types of cables and connectors used to connect these many types of external devices to computers.

3. **Define PCI.**

Stands for "Peripheral Component Interconnect." PCI is a hardware bus used for adding internal components to a desktop computer. PCI card can be inserted into a PCI slot on a motherboard, providing additional I/O ports on the back of a computer.

4. **What is BIOS? (2020(W))**

   Short for Basic Input/output System, the BIOS is a ROM chip found on motherboards that allows you to access and set up your computer system at the most basic level.

LONG QUESTION

1. Explain Hardware BIOS interaction. (2020(w).
2. Describe the different components and slots of motherboard. (2020(w)
3. Difference between Core 2 Duo and Quad core processor.(2020(w)

CHAPTER-4

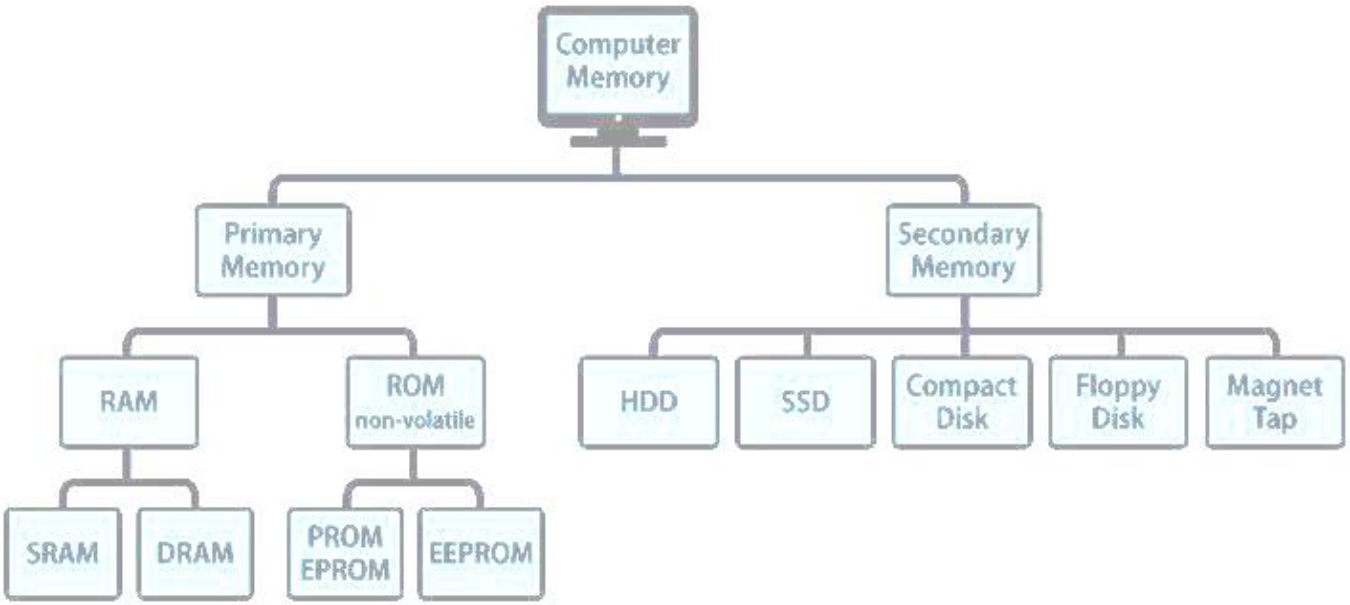
MEMORY AND I/O DEVICES

4.1 PRI MARY AND SECO ND ARY ME MO RY:
4.2 MEMO RY S PE ED , ACCES S TI ME
4.3 H ARD D IS K - CONST RUCTIO N , WO RKING PRINC IPL ES
4.4 F ILE SYSTEM, FO RMA TTING , PARTI TIO NING:
FILE SYSTEM:
4.5 REMO VABL E STORA GE AND S PECIAL DEV ICES AND THEIR W ORKING PRINC IPL ES (CD , D VD , EXTERNA L DRIVES, MEMO RY S TICK, USB F L ASH D RIV E, SSD):
4.6 KEY BO ARD (INTERFA CING , USB, WIREL ESS, TYPE S O F KEY S, KEY BO ARD MA TRIX, KEY BO UN CING):
4.7 MO US E INT ERF ACIN G:

4.1 PRIMARY AND SECONDARY MEMORY:

Although many types of memory in a computer exist, the most basic distinction is between primary memory, often called system memory, and secondary memory, which is more commonly called storage. The key difference between primary and secondary memory is speed of access.

- **Primary memory** includes ROM and RAM, and is located close to the CPU on the computer motherboard, enabling the CPU to read data from primary memory very quickly indeed. It is used to store data that the CPU needs imminently so that it does not have to wait for it to be delivered.
- **Secondary memory** by contrast, is usually physically located within a separate storage device, such as a hard disk drive (HDD) or solid state drive (SSD), which is connected to the computer system either directly or over a network. The cost per gigabyte of secondary memory is much lower, but the read and write speeds are significantly slower.



Primary Memory Types: RAM and ROM

There are two key types of primary memory:

1. RAM, or random access memory
2. ROM, or read-only memory

Let's look in-depth at both types of memory.

1) RAM Computer Memory

- The acronym RAM stems from the fact that data stored in random access memory can be accessed – as the name suggests – in any random order. Or, put another way, any random bit of data can be accessed just as quickly as any other bit.

- The most important things to understand about RAM are that RAM memory is very fast, it can be written to as well as read, it is volatile (so all data stored in RAM memory is lost when it loses power) and, finally, it is very expensive compared to all types of secondary memory in terms of cost per gigabyte.

- It is because of the relative high cost of RAM compared to secondary memory types that most computer systems use both primary and secondary memory. Data that is required for imminent processing is moved to RAM where it can be accessed and modified very quickly, so that the CPU is not kept waiting.

- When the data is no longer required it is shunted out to slower but cheaper secondary memory, and the RAM space that has been freed up is filled with the next chunk of data that is about to be used.

Types of RAM

- **DRAM**: DRAM stands for Dynamic RAM, and it is the most common type of RAM used in computers. The oldest type is known as single data rate (SDR) DRAM, but newer computers use faster dual data rate (DDR) DRAM. DDR comes in several versions including DDR2, DDR3, and DDR4, which offer better performance and are more energy efficient than DDR. However different versions are incompatible, so it is not possible to mix DDR2 with DDR3 DRAM in a computer system. DRAM consists of a transistor and a capacitor in each cell.
- **SRAM**: SRAM stands for Static RAM, and it is a particular type of RAM which is faster than DRAM, but more expensive and bulker, having six transistors in each cell. For those reasons SRAM is generally only used as a data cache within a CPU itself or as RAM in very high-end server systems. A small SRAM cache of the most imminently-needed data can result in significant speed improvements in a system

2) ROM Computer Memory

- ROM stands for read-only memory, and the name stems from the fact that while data can be read from this type of computer memory, data cannot normally be written to it. It is a very fast type of computer memory which is usually installed close to the CPU on the motherboard.

- ROM is a type of non-volatile memory, which means that the data stored in ROM persists in the memory even when it receives no power – for example when the computer is turned off. In that sense it is similar to secondary memory, which is used for long term storage.

- When a computer is turned on, the CPU can begin reading information stored in ROM without the need for drivers or other complex software to help it communicate.

- The ROM usually contains "bootstrap code" which is the basic set of instructions a computer needs to carry out to become aware of the operating system stored in secondary memory, and to load parts of the operating system into primary memory so that it can start up and become ready to use. ROM is also used in simpler electronic devices to store firmware which runs as soon as the device is switched on.

Types of ROM

ROM is available in several different types, including PROM, EPROM, and EEPROM.

- **PROM:** PROM stands for Programmable Read-Only Memory, and it is different from true ROM in that while a ROM is programmed (i.e. has data written to it) during the manufacturing process, a PROM is manufactured in an empty state and then programmed later using a PROM programmer or burner.
- **EPROM:** EPROM stands for Erasable Programmable Read-Only Memory, and as the name suggests, data stored in an EPROM can be erased and the EPROM reprogrammed. Erasing an EPROM involves removing it from the computer and exposing it to ultraviolet light before re-burning it.
- **EEPROM:** EEPROM stands for Electrically Erasable Programmable Read-Only Memory, and the distinction between EPROM and EEPROM is that the latter can be erased and written to by the computer system it is installed in. In that sense EEPROM is not strictly read-only. However in many cases the write process is slow, so it is normally only done to update program code such as firmware or BIOS code on an occasional basis.

Secondary Memory Types

Secondary memory comprises many different storage media which can be directly attached to a computer system. These include:

Hard Disc:

- This is the main storage device of the computer which is fixed inside the CPU box. Its storage capacity is very high that varies from 200 GB to 3 TB. As it is fixed inside the CPU box, it is not easy to move the hard disc from one computer to another. A hard disc contains a number of metallic discs which are called platters.

- Information is recorded on the surface of the platters in a series of concentric circles. These circles are called Tracks.

- For the purpose of addressing information, the surface is considered to be divided into segments called Sectors. This division helps in the proper organisation of data on the platter and

helps in maximum utilisation of the storage space.

Compact Disc(CD):

- It is a thin plastic disc coated with metal. Computer can read and write data stored on it. This is an optical storage device with a storage capacity of up to 700 MB and it can store varieties of data like pictures, sounds, movies, texts, etc.

CD-ROM:

- CD-ROM refers to Compact Disc-Read Only Memory. Data or information is recorded at the time of manufacturing and it can only be read. A CD-ROM cannot be used to record fresh data by the computer.

CD-R:

- CD-R is the short form of Compact Disc-Recordable. Data can be written on it once and can be read whenever required. The data written once cannot be erased.

CD-RW:

- CD-RW stands for Compact Disc Re-writable. CD-RW can be used to write information over and over again, i.e., previous information can be erased and new information can be written on it using a CD writer fixed inside the CPU box.
- CDs are slow in comparison to hard discs to read or write the information on them. They are portable storage devices.

DVD:

- DVD stands for Digital Versatile Disc.it is an optical storage device which reads data faster than a CD.A single layer, single sided DVD can store data up to 4.7 GB, i.e., around 6 times than that of CD and a double layer DVD can store data up to 17.08 GB, i.e., around 25 times that of CD. Though DVDs look just like CDs, they can hold much more data, for example, a full length movie.

Blu-ray Disc:

- This is a newly invented optical data storage device whose storage capacity can be form 25 GB up to 200 GB.it is mainly used to store high quality sound and movie data. They are the scratch resistant discs, that's why, storing data on these is much safer than a CD OR DVD.

Flash Drive:

- It is an electronic memory device popularly known as pen drive in which data can be stored permanently and erased when not needed.it

is a portable storage device that can be easily connected and removed from the CPU to store data in it. Its capacity can vary form 2 GB to 256 GB.

4.2 MEMORY SPEED, ACCESS TIME

Memory Speed:

- The speed of the memory will determine the rate at which the CPU can process data. The higher the clock rating on the memory, the faster the system is able to read and write information from the memory. All memory is rated at a specific clock rate in megahertz that matches the CPU's memory interface speed. Newer memory- classifying methods now refer to them based on the theoretical data bandwidth that the memory supports.

Types of Memory Speeds:

- All the versions of DDR memory are referred to by the clock rating but, more frequently, memory manufacturers are starting to refer to the bandwidth of the memory. These memory types can be listed in two ways.
- The first method lists the memory by its overall clock speed and the version of DDR that is used. For example, you may see mention of 1600 MHz DDR3 or DDR3-1600 which essentially is just the type and the speed combined. The other method of classifying the modules is by their bandwidth rating in megabytes per second. 1600 MHz memory runs at a theoretical speed of 12,800 megabytes per second. Thus DDR3- 1600 memory is also referred to as PC3-12800 memory.
- Here is a short conversion of some of the standard DDR memory that can be found:

- DDR3-1066 = PC3-8500
- DDR3-1333 = PC3-10600
- DDR3-1600 = PC3-12800
- DDR4-2133 = PC4-17000
- DDR4-2666 = PC4-21300
- DDR4-3200 = PC4-25600

It's important to know the maximum speed of memory that your processor can support.

For example, your processor may only support up to 2666MHz DDR4 memory. You can still use 3200MHz rated memory with the processor but the motherboard and CPU will adjust the speeds down to effectively run at 2666MHz. The result is the memory is run at less than its full potential bandwidth. As a result, you want to buy memory that best matches your computer's capabilities.

Access Time:

- The time a program or device takes to locate a single piece of information and make it available to the computer for processing.
- DRAM (dynamic random access memory) chips for personal computers have access times of 50 to 150

nanoseconds (billionths of a second). Static RAM (SRAM) has access times as low as 10 nanoseconds. Ideally, the access time of memory should be fast enough to keep up with the CPU.

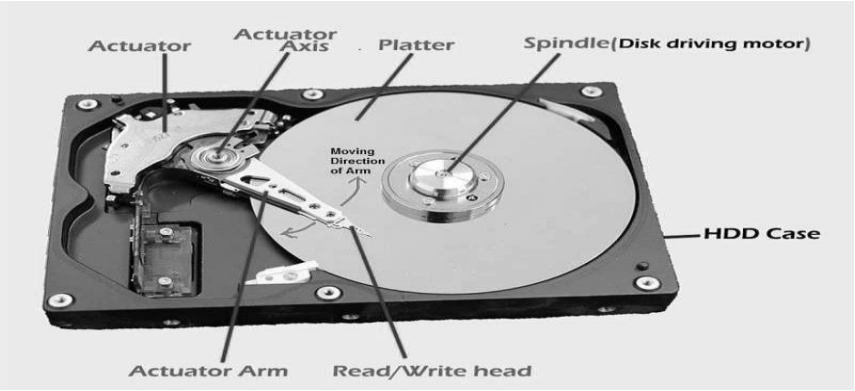
- If not, the CPU will waste a certain number of clock cycles, which makes it slower. Note, however, that reported access times can be misleading because most memory chips, especially DRAM chips, require a pause between back-to-back accesses.

- This is one reason why SRAM is so much faster than DRAM, even when the reported access times are equivalent; SRAM doesn't require any refreshes, so there is no pause between back-to-back accesses. A more important measurement of a chip's speed, therefore, is its cycle time, which measures how quickly two back-to-back accesses can be made.

- Access time is also frequently used to describe the speed of disk drives. Disk access times are measured in milliseconds (thousandths of a second), often abbreviated as ms. Fast hard disk drives for personal computers boast access times of about 9 to 15 milliseconds.

- Note that this is about 200 times slower than average DRAM. The access time for disk drives includes the time it actually takes for the read/write head to locate a sector on the disk (called the seek time). This is an average time since it depends on how far away the head is from the desired data.

4.3 HARD DISK - CONSTRUCTION, WORKING PRINCIPLES



CONSTRUCTION:

- A typical HDD has two electric motors: a spindle motor that spins the disks and an actuator (motor) that positions the read/write head assembly across the spinning disks. The disk motor has an external rotor attached to the disks; the stator windings are fixed in place. Opposite the actuator at the end of the head support arm is the read-write head; thin printed-circuit cables connect the read- write heads to amplifier electronics mounted at the pivot of the actuator. The head support arm is very light, but also stiff; in modern drives, acceleration at the head reaches 550 g. The actuator is a permanent magnet and moving coil motor that swings the heads to the desired position.
- A metal plate supports a squat neodymium- iron-boron (NIB) high-flux magnet. Beneath this plate

is the moving coil, often referred to as the voice coil by analogy to the coil in loudspeakers, which is attached to the actuator hub, and beneath that is a second NIB magnet, mounted on the bottom plate of the motor (some drives have only one magnet).

- The voice coil itself is shaped rather like an arrowhead and is made of doubly coated copper magnet wire. The inner layer is insulation, and the outer is thermoplastic, which bonds the coil together after it is wound on a form, making it self-supporting.
- The portions of the coil along the two sides of the arrowhead (which point to the center of the actuator bearing) then interact with the magnetic field of the fixed magnet. Current flowing radially outward along one side of the arrowhead and radially inward on the other produces the tangential force.
- If the magnetic field were uniform, each side would generate opposing forces that would cancel each other out. Therefore, the surface of the magnet is half north pole and half south pole, with the radial dividing line in the middle, causing the two sides of the coil to see opposite magnetic fields and produce forces that add instead of canceling.
- Currents along the top and bottom of the coil produce radial forces that do not rotate the head. The HDD's electronics control the movement of the actuator and the rotation of the disk and perform reads and writes on demand from the disk controller.

WORKING PRINCIPLES:

- A modern HDD records data by magnetizing a thin film of ferromagnetic material on both sides of a disk. Sequential changes in the direction of magnetization represent binary data bits.
- The data is read from the disk by detecting the transitions in magnetization. User data is encoded using an encoding scheme, such as run-length limited encoding, which determines how the data is represented by the magnetic transitions.
- A typical HDD design consists of a spindle that holds flat circular disks, called platters, which hold the recorded data. The platters are made from a non-magnetic material, usually aluminum alloy, glass, or ceramic.
- They are coated with a shallow layer of magnetic material typically 10–20 nm in depth, with an outer layer of carbon for protection. For reference, a standard piece of copy paper is 0.07–0.18 mm (70,000–180,000 nm) thick. The platters in contemporary HDDs are spun at speeds varying from 4,200 RPM in energy-efficient portable devices, to 15,000 rpm for high-performance servers.
- The first HDDs spun at 1,200 rpm and, for many years, 3,600 rpm was the norm. As of November 2019, the platters in most consumer-grade HDDs spin at 5,400 or 7,200 RPM. Information is written to and read from a platter as it rotates past devices called read-and-write heads that are positioned to operate very close to the magnetic surface, with their flying height often in the range of tens of nanometers.
- The read-and-write head is used to detect and modify the magnetization of the material passing immediately under it. In modern drives, there is one head for each magnetic platter surface on the spindle, mounted on a common arm. An actuator arm (or access arm) moves the heads on an arc

(roughly radially) across the platters as they spin, allowing each head to access almost the entire surface of the platter as it spins. The arm is moved using a voice coil actuator or in some older designs a stepper motor.

- Early hard disk drives wrote data at some constant bits per second, resulting in all tracks having the same amount of data per track but modern drives (since the 1990s) use zone bit recording – increasing the write speed from inner to outer zone and thereby storing more data per track in the outer zones.

4.4 FILE SYSTEM, FORMATTING, PARTITIONING:

FILE SYSTEM:

- Any computer file is stored on a storage medium with a given capacity. In actual fact, each storage is linear space for reading or both reading and writing digital information. Each byte of information on it has its offset from the storage start known as an address and is referenced by this address.
- A storage can be presented as a grid with a set of numbered cells (each cell is a single byte). Any file saved to the storage gets its own cells. Generally, computer storages use the pair of a sector and in-sector offset to reference any byte of information on the storage.
- A sector is a group of bytes (usually 512 bytes), a minimum addressable unit of the physical storage.
- For example, byte 1040 on a hard disk will be referenced as a sector #3 and offset in sector 16 bytes ([sector]+[sector]+[16 bytes]).

FILE SYSTEMS OF WINDOWS:

- Microsoft Windows employs two major file systems: NTFS, the primary format most modern versions of this OS use by default, and FAT, which was inherited from old DOS and has exFAT as its later extension. In addition, the ReFS file system was developed by Microsoft as a new generation file system for server computers starting from Windows Server 2012.

FAT:

- FAT (File Allocation Table) is one of the simplest file system types, which has been around since the 1980s. It consists of the file system descriptor sector (boot sector or superblock), the file system block allocation table (referred as the File Allocation Table) and plain storage space for storing files and folders.
- Files in FAT are stored in directories. Each directory is an array of 32-byte records, each defining a file or extended attributes of a file (e.g. a long file name). A file record attributes the first block of a file. Any next block can be found through the block allocation table by using it as a linked list. The block allocation table contains an array of block descriptors.
- A zero value indicates that the block is not used and a non-zero one relates to the next block of a file or a special value for the file end. The numbers in FAT12, FAT16, FAT32 stand for the number of bits used to enumerate a file system block. This means that FAT12 can use up to 4096 different block references, while FAT16 and FAT32 can use up to 65536 and 4294967296 accordingly.

- The actual maximum count of blocks is even less and depends on the implementation of the file system driver. FAT12 and FAT16 used to be applied to old floppy disks and do not find extensive employment nowadays.
- FAT32 is still widely used for memory cards and USB sticks. The system is supported by smartphones, digital cameras and other portable devices. FAT32 can be used on Windows-compatible external storages or disk partitions with the size under 32 GB (Windows cannot create a FAT32 file system which would be larger than 32 GB, although Linux supports the size up to 2 TB) and doesn't allow to create files the size of which exceeds 4 GB. To address this issue, exFAT was introduced, which doesn't have any realistic limitations concerning the size of files or partitions.

NTFS:

- NTFS (New Technology File System) was introduced in 1993 with Windows NT and is currently the most common file system for end user computers based on Windows. Most operating systems of the Windows Server line use this format as well.
- The file system is quite reliable thanks to journaling and supports many features, including access control, encryption, etc. Each file in NTFS is stored as a file descriptor in the Master File Table and file content. The Master file table contains entries with all information about files: size, allocation, name, etc.
- The first 16 entries of the Master File Table are retained for the BitMap, which keeps record of all free and used clusters, the Log used for journaling records and the BadClus containing information about bad clusters. The first and the last sectors of the file system contain file system settings (the boot record or the superblock).
- This file system uses 48 and 64 bit values to reference files, thus being able to support data storages with extremely high capacity.

ReFS:

- ReFS (Resilient File System) is the latest development of Microsoft introduced with Windows 8 and now available for Windows 10. The file system architecture absolutely differs from other Windows file systems and is mainly organized in a form of the B+-tree. ReFS has high tolerance to failures due to new features included into the system. And, namely, Copy-on-Write (CoW): no metadata is modified without being copied; data is not written over the existing data, but into new disk space.
- With any file modifications, a new copy of metadata is stored into free storage space, and then the system creates a link from older metadata to the newer one. Thus, the system stores significant quantity of older backups in different places providing easy file recovery unless this storage space is overwritten.

FILE SYSTEMS OF MACOS:

- Apple's macOS applies two file systems: HFS+, an extension to their own HFS file system used on old Macintosh computers, and recently released APFS.

HFS+:

- HFS+ used to be the primary file system of Apple desktop products, including Mac computers, iPods, as well as Apple X Server products before it was replaced by APFS in macOS High Sierra. Advanced server products also use Apple Xsan file system, a clustered file system derived from StorNext and CentraVision.
- The HFS+ file system uses B-trees for placing and locating files. Volumes are divided into sectors, typically 512 bytes in size, which are then grouped into allocation blocks, the number of which depends on the size of the entire volume. The information concerning free and used allocation blocks is kept in the Allocation File.
- All allocation blocks assigned to each file as extends are recorded in the Extends Overflow File. And, finally, all file attributes are listed in the Attributes file. Data reliability is improved through journaling which makes it possible to keep track of all changes to the system and quickly return it back to the working state in case of unexpected events. Among other supported features are hard links to directories, logical volume encryption, access control, data compression, etc.

APFS:

- The Apple file system is aimed to address fundamental issues present in its predecessor and was developed to efficiently work with modern flash storages and solid-state drives.
- This 64-bit file system uses the copy-on-write method to increase performance, which allows to copy each block before the changes to it are applied, and offers a lot of data integrity and space-saving features. All the file contents and metadata about files, folders along with other APFS structures are kept in the APFS container.
- The Container Superblock stores information about the number of blocks in the Container, the block size, etc. Information about all allocated and free blocks of the Container is managed with the help of Bitmap Structures. Each volume in the Container has its own Volume Superblock which provides information about this volume. All files and folders of the volume are recorded in the File and Folder B- Tree, while the Extents B-Tree is responsible for extents – references to file contents (file start, its length in blocks).

FILE SYSTEMS OF LINUX:

- Open-source Linux aims at implementing, testing and using different types of file systems. The most popular Linux file systems include:
- **Ext:** Ext2, Ext3, Ext4 - a "native" Linux file system. This file system falls under active developments and improvements. Ext3 file system is just an extension of Ext2 that uses transactional file writing operations with a journal. Ext4 is a further development of Ext3, extended with the support of optimized file allocation information (extents) and extended file attributes. This file system is frequently used as a "root" file system for most Linux installations.

ReiserFS:

- ReiserFS - an alternative Linux file system for storing a huge number of small files. It has good

capability of files search and enables compact files allocation by storing file tails or small files along with metadata in order not to use large file system blocks for the same purpose. However, this file system no longer receives active support.

XFS:

- XFS - a file system derived from SGI company and was initially used for company's IRIX servers. Now XFS specifications are implemented in Linux. XFS file system has great performance and is widely used to store files.

JFS:

- JFS - a file system developed by IBM for the company's powerful computing systems. JFS1 usually stands for JFS, JFS2 is the second release. Currently, this file system is open-source and implemented in most modern Linux versions.

FORMATTING:

- Formatting is the process of preparing a data storage device such as a hard disk drive, solid-state drive, floppy disk or USB flash drive for initial use. In some cases, the formatting operation may also create one or more new file systems. The first part of the formatting process that performs basic medium preparation is often referred to as "low-level formatting".
- Partitioning is the common term for the second part of the process, making the data storage device visible to an operating system. The third part of the process, usually termed "high-level formatting" most often refers to the process of generating a new file system. In some operating systems all or parts of these three processes can be combined or repeated at different levels and the term

1. Low-level formatting (i.e., closest to the hardware) marks the surfaces of the disks with markers indicating the start of a recording block (typically today called sector markers) and other information like block CRC to be used later, in normal operations, by the disk controller to read or write data. This is intended to be the permanent foundation of the disk, and is often completed at the factory.
2. Partitioning divides a disk into one or more regions, writing data structures to the disk to indicate the beginning and end of the regions. This level of formatting often includes checking for defective tracks or defective sectors.
3. High-level formatting creates the file system format within a disk partition or a logical volume. This formatting includes the data structures used by the OS to identify the logical drive or partition's contents. This may occur during operating system installation, or when adding a new disk. Disk and distributed file system may specify an optional boot block, and/or various volume and directory information for the operating system.

PARTITIONING:

- Disk partitioning or disk slicing is the creation of one or more regions on secondary storage, so that each region can be managed separately. These regions are called partitions. It is typically the first step of preparing a newly installed disk, before any file system is created.
- The disk stores the information about the partitions' locations and sizes in an area known as the

partition table that the operating system reads before any other part of the disk. Each partition then appears to the operating system as a distinct "logical" disk that uses part of the actual disk.

PC PARTITION TYPES:

- This section describes the master boot record (MBR) partitioning scheme, as used historically in DOS, Microsoft Windows and Linux (among others) on PC-compatible computer systems.
- As of the mid-2010s, most new computers use the GUID Partition Table (GPT) partitioning scheme instead. For examples of other partitioning schemes, see the general article on partition tables.
- The total data storage space of a PC HDD on which MBR partitioning is implemented can contain at most four primary partitions, or alternatively three primary partitions and an extended partition. The Partition Table, located in the master boot record, contains 16-byte entries, each of which describes a partition.
- The partition type is identified by a 1-byte code found in its partition table entry. Some of these codes (such as 0x05 and 0x0F) may be used to indicate the presence of an extended partition. Most are used by an operating system's bootloader (that examines partition tables) to decide if a partition contains a file system that can be mounted

/ accessed for reading or writing data.

Primary partition:

- A primary partition contains one file system. In DOS and all early versions of Microsoft Windows systems, Microsoft required what it called the system partition to be the first partition. All Windows operating systems from Windows 95 onwards can be located on (almost) any partition, but the boot files (io.sys, bootmgr, ntldr, etc.) must reside on a primary partition. However, other factors, such as a PC's BIOS (see Boot sequence on standard PC) may also impose specific requirements as to which partition must contain the primary OS.

- The partition type code for a primary partition can either correspond to a file system contained within (e.g., 0x07 means either an NTFS or an OS/2 HPFS file system) or indicate that the partition has a special use (e.g., code 0x82 usually indicates a Linux swap partition). The FAT16 and FAT32 file systems have made use of a number of partition type codes due to the limits of various DOS and Windows OS versions.

- Though a Linux operating system may recognize a number of different file systems (ext4, ext3, ext2, ReiserFS, etc.), they have all consistently used the same partition type code: 0x83 (Linux native file system).

Extended partition:

- An HDD may contain only one extended partition, but that extended partition can be subdivided into multiple logical partitions. DOS/Windows systems may then assign a unique drive letter to each logical partition.

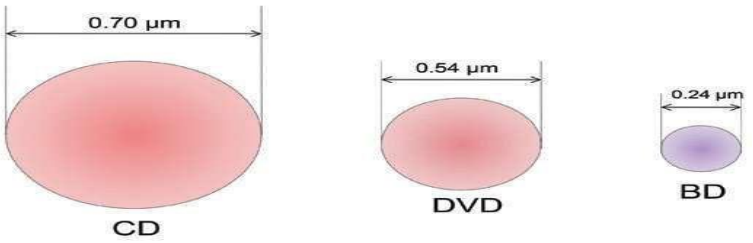
4.5 REMOVABLE STORAGE AND SPECIAL DEVICES AND THEIR WORKING

PRINCIPLES (CD, DVD, EXTERNAL DRIVES, MEMORY STICK, USB FLASH DRIVE, SSD):

Replicated CDs, DVDs and BDs (-ROMs):

- These discs consist of a transparent body

in the reflection of the laser beam at the transition between pits and lands. Such changes represent digital 1's while no change represents 0's. DVDs have narrower tracks and shorter pit/land lengths than CDs: they use a shorter wavelength laser. The basic disc



is only 0.6 mm thick. With single sided DVDs, a blank second carbonate layer is bonded to the information carrying half. With double sided discs, a second information-carrying half is attached. Additionally,

- it is possible to add a second, semi-transparent layer (dual layer) to each data layer. This makes two layers readable from each side, almost quadrupling the storage capacity. Replicated Blu-ray discs (BDs) consist of two laminated polycarbonate bodies of different thicknesses.

- The lower, thinner one carries the pit-land track on its upper side covered by the reflective layer. The track is narrower than that of a DVD or CD. The upper, thicker polycarbonate body carries the label on its upper surface. Unlike DVDs, there are no double-sided discs, but dual layer BDs are available.

Recordable optical discs ("Dye Discs", CD-Rs, DVD-Rs, BD-Rs):

- The information layer consists of a groove in the upper surface of the polycarbonate body filled with an organic dye. Recording is made by a laser of much higher energy than the reading laser, which heats ("burns") the dye. By this process, a sequence of burned and non-burned spots are created.
- The transitions between burnt and un-burnt areas are recognized by the reading laser in the same way as the pits and lands of replicated ROM-discs. Reflecting layers are of gold, silver, or silver alloy.

Rewritable optical discs (CD-RWs, DVD-RWs, BD-RWs):

- The information layer consists of a phase-changing metal alloy. Recording is made by a writing laser that heats up the metal alloy film at the exposed spot, inducing a phase change from crystalline to amorphous and vice versa, controlled by the burning temperature of the writing laser. Dielectric layers on both sides of the metal alloy film cause rapid cooling; the heated spots keep the changed phase

after cooling.

- The amorphous film spots reflect the light of a reading laser with lower intensity than the crystalline areas allowing the transition between states to be recognized. Data can be erased and rewritten for a limited number of times (up to 1000 times).
- **External Storage Device:**

An external storage device, also referred to as auxiliary storage and secondary storage, is a device that contains all the addressable data storage that is not inside a computer's main storage or memory.

- An external storage device can be removable or non-removable, temporary or permanent, and accessible over a wired or wireless network. External storage enables users to store data separately from a computer's main or primary storage and memory at a relatively low cost. It increases storage capacity without having to open up a system.
- External storage is often used to store information that's accessed less frequently by applications running on a desktop, laptop, server or mobile device, such as an Android or iOS smartphone or tablet. For PCs, an external storage device often consists of stationary or portable hard disk drives (HDDs), or solid-state drives (SSDs) attached via a USB or FireWire connection, or wirelessly.
- For enterprises, an external storage device can serve as primary storage connected to servers through Ethernet or Fibre Channel switches, or as secondary storage for backup and archiving purposes. External storage offers HDD, all-flash and hybrid storage arrays for block-based, file-based or object storage, or a mix of these three protocols known as unified storage. Storage area networks (SANs) for block-level storage and network-attached storage (NAS) devices for file-based storage are examples of external storage.
- Another common use case for an external storage device is to transport data between on-site and off-site computer systems. When moving large amounts of data to the cloud, providers will often use external storage devices in a practice known as cloud seeding.
- Because moving tens of terabytes of data over a network can take hours or days, customers place their data on an external storage device and then send the device to their chosen provider to copy locally. After the initial seeding, only changed data will move across the network to the cloud for backup, archiving or disaster recovery (DR) purposes.

Memory stick, USB flash drive, Solid state drive:

- **What is Flash Memory:** Flash memory is a type of erasable read-only memory (EEPROM) that clears and rewrites data in chunks for fast, energy-efficient access and rewriting. Flash memory, or flash storage, is non-volatile, which means it remains viable even without an active power source. Although technically a type of read-only memory (ROM), flash memory is distinct from conventional ROM in that you can edit it as well as read it.
- **How Does Flash Memory Work:** Flash memory comes built into solid-state chips, and each chip

houses an array of flash memory cells. Rather than use the traditional electromechanical method, flash memory uses electrical circuits to log data. Here's the process:

1. Current flows through the transistor between each cell's source (electric input) and drain (electric output).
2. The transistor controls the current's path of by acting as an on-off switch, or a gate.
3. An "on" transistor allows the flow of electrons across the cell, which stores a 1 in binary code.
4. An "off" transistor blocks electrons and stores a 0.

- Volatile memory like random access memory (RAM) returns all the gates to the 0 state when the power source turns off, thus erasing all stored data. But ROM, including flash memory, works by adding a second gate, known as the "floating gate," to each cell. As electrons pass through a transistor in the "on" state, some get stuck to the floating gate and remain there to store a 1 indefinitely, with or without power.

- All types of programmable ROM (PROM) experience this partial loss of electrons. In electrically erasable PROM (EEPROM), the gate will only stop electrons when a user applies a specific negative voltage to the gate to return the transistor to 0.

Types of Flash Memory (NOR and NAND):

- Flash memory comes in two basic types: NOR and NAND. The names reflect the types of logic gates each type utilizes. Logic gates are groups of transistors that work together to carry out an "if-then" operation to produce the desired output. The logic gate's structure determines which output will result from any possible input.

-NOR flash memory: NOR has a faster read speed than NAND and can read and edit more precisely, but it comes at a higher price point per byte. Users choose NOR flash memory mostly for executing code.

-NAND flash memory: NAND has a slower read speed and can only access memory in blocks rather than bytes, but it is cheaper than NOR. It works well for storing large and frequently-updated files.

Pros and Cons of Flash Memory:

Disadvantage: (Editing Ability) The main drawback of most EEPROM is that editing memory byte by byte can take an unacceptably long amount of time. Flash memory addresses this issue by grouping bytes into chunks, or "blocks," which cuts down the editing time significantly. Grouping the bytes into blocks speeds up the process, but it also means you lose the ability to edit specific bytes.

- A computer can read a specific byte from any address on the flash chip, but it can only erase and rewrite in block units.

Disadvantage: (Lifetime) Flash memory does not have an infinite lifetime. Applying high voltage fields eventually degrades the transistors, which means the floating gates will take longer to work. However, most types of flash don't start to slow down until at least 10,000 rewrites, and you can distribute those edits over the entire chip to limit the functional impact of the wear and maintain utility for much longer.

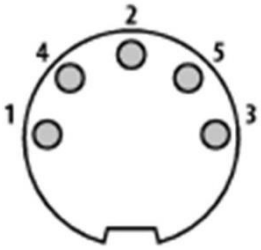
Advantage: (Efficiency) Because flash memory stores data without the use of moving mechanical parts, its operation requires less energy than older systems. Flash memory also stores data much more compactly than a hard drive can.

4.6 KEY BOARD (INTERFACING, USB, WIRELESS, TYPES OF KEYS, KEYBOARD MATRIX, KEY BOUNCING):

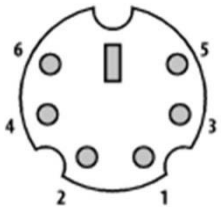
Keyboard Interfaces:

Keyboard interfaces are well standardized, and have been for years. This means that, with the exception of antique PC and PC/XT keyboards, you can plug any keyboard into any PC to which it can physically connect and expect it to work. The following sections detail the three keyboard interfaces currently in use.

AT Keyboard Interface:



- The AT keyboard interface was introduced with the IBM PC/AT in 1984, and is still used by the few AT and BAT motherboards still being produced. AT keyboards use the 5-pin DIN connector (female at the PC), On the PC side, the AT keyboard uses an Intel 8042 or equivalent interface chip, which is assigned IRQ1 and I/O base address 0060.
- The pin descriptions are self-explanatory, other than Pin 3. The 83-key IBM PC/XT keyboard and some 84-key IBM PC/AT keyboards used an early keyboard protocol that did not include a software reset command. For these keyboards, the PC uses Pin 3 to send a hardware reset to the keyboard. All systems and keyboards made in the last 15 years use a keyboard protocol that includes a software reset command, and nearly all recent keyboards leave Pin 3 unconnected.



PS/2 Keyboard Interface:

- The PS/2 keyboard interface was introduced with the IBM PS/2 series in 1986, and is now used by all ATX and ATX-variant motherboards.
- PS/2 keyboards use the 6-pin mini-DIN connector (female at the PC), On the PC side, the PS/2 keyboard uses the same Intel 8042 or equivalent interface chip as the AT keyboard, which is also assigned IRQ1 and I/O base address 0060.
- The AT and PS/2 keyboard interfaces use incompatible connectors, but are electrically and functionally identical. You can connect an AT keyboard to a PS/2 keyboard port or vice versa by building or buying an adapter that uses the pinouts.
- Many new keyboards come with an adapter to allow their use with the other style connector. Such adapters can also be purchased at most computer stores.

USB Keyboard Interface:

- Some keyboards can be connected to a USB port. Most USB-capable keyboards also provide a standard PS/2 connector, via either a split cable with both USB and PS/2 connectors or a separate adapter that converts the USB connector to PS/2.

- To use a USB keyboard, the PC BIOS must support USB keyboards, and you must run an operating system, such as Windows 9X/2000/XP or Linux, that supports USB. BIOS support is needed so that the keyboard can be used before the operating system loads to do such things as changing Setup parameters or choosing options from a boot menu. Operating system support is required for the keyboard to be accessible after the system boots.

Types of keys:

Pretty much all computer keyboards include some of the same keyboard keys,

including letters, numbers and special symbols. Some also have special function and command types of keyboard keys that can be used to give commands to a computer rather than simply for typing.

Alphanumeric Keyboard Keys:

- Every keyboard contains a set of keys known as the alphanumeric keys. The term "alphanumeric" refers to either letters or numbers, but not symbols or command keys. The number keys on a computer keyboard are often located in two different spots on the keyboard: above the letters and to the right of the letters.
- The number keys located directly above the letters double as symbol keys. Pressing shift and holding down a number will type whatever symbol is also on that number key.

- Symbol keys include the "dollar sign," the "percentage sign" and the "number sign." The letter keys are set up the same way from keyboard to keyboard. On the top row, the letters "Q,W,E,R,T and Y" are lined up. For this reason, this common layout is often called QWERTY.

Punctuation Keys:

- The punctuation keys are the keys on the keyboard that relate to punctuation. Examples of these keys include the "comma key," the "question mark key," the "colon key" and the "period key." All of these

- keys – which can be located to the right of the letter keys – have multiple functions. For example, the "question mark key" doubles as the slash (/) key.
- The "colon key" doubles as the "semi-colon" key. Like the number keys, pressing shift while holding down a punctuation key will allow you to type the other function.

Navigation Keys:

- The navigation keys are located between the letter keys and the numbers keys on the far right of the keyboard. The navigation keys consist of four arrows: one pointing up, one pointing down, one pointing right and one pointing left. These keys move the cursor around your display screen, much like a mouse would except not as fluid.
- These keys come in handy when you are writing a document and want to move the cursor up, down, left or right on the page. Wherever the cursor lands is where the next letter, number or symbol will be typed. You can also use the navigation keys to scroll through the history of sites you have visited online.

Function Keys:

Many computer keyboards have "function keys," beginning with the letter F. They're typically located at the top of a keyboard. These are used to invoke functions in various programs. For example, F1 is used in many Windows programs to open the "help" menu.

Other Special Keys:

- Command keys on a keyboard are keys that relay a command, such as "delete," "return" and "enter." Depending on your keyboard, you may have special keys up top – located above the numbers – that control the volume of your speakers, or the fast forward/rewind option when viewing a film.
- An eject key you press to load CDs or DVDs. The "control key" and the "alt key" can also be used in conjunction with other keys for shortcuts. Many keyboards designed for Microsoft Windows have a "Windows key," with a Microsoft Windows logo. It can be used to open the Windows Start Menu. When it's used on other operating systems, it's sometimes called the "Super" key.

Keyboard Matrix Circuit:

- Unless a computer has a touchscreen interface, it probably supports input through peripherals, the most common of which is a keyboard. There are several different types of keyboards, including membrane, dome-switch, capacitive, mechanical- switch, buckling-spring, hall-effect, optical and more. Each type has its own unique characteristics.
- Keyboards used for computers, however, are often designed in a special format known as a matrix circuit. So, what is a keyboard matrix circuit and how does it work exactly? In the most basic sense, a keyboard matrix circuit is a type of keyboard that features a grid-like array of wires
- connecting the key switches (hence the name).
- If the keyboard features 8 rows and 8 columns of wires, for instance, it can support up to 64 keys. The switches are located at the intersection of these wires.
- Keyboard matrix circuits contain a scanner that's constantly scanner the grid; thus, allowing it to

determine which key is pressed. If you press the “H” key on a keyboard matrix circuit, for instance, the scanner will notice the switch being activated at the intersection of the wires where the “H” key is located. It’s a fast and accurate process that works well for most keyboards. The primary benefit of using a matrix circuit design is a reduction of required wires. In keyboards with a matrix circuit, there’s typically a single wire for every key. If the keyboard features 64 keys, for instance, it would need 64 wires.

- However, there are also some drawbacks to using keyboard matrix circuits, one of which is its use of binary on and off signals. When compared to other keyboards that use two sets of switches for each key, keyboard matrix circuits have a lower level of performance than their counterpart. Secondly, keyboard matrix circuits used in musical instructions typically lack diodes at the intersections of the wires.

- This can result in phantom keys where the keyboard “thinks” a key is pressed when it is really not; thus, increasing the risk of errors. To recap, keyboard matrix circuits are characterized by the use of a grid-like array of intersecting wires underneath the keys. They feature a sensor that’s specifically used to monitor these wires, which it uses to determine when and where a keypress occurs.

Key Bouncing:

- Key Bounce (also known as 'chattering') occurs in mechanical switches and can cause one switch press to be detected as multiple presses. Typically this is filtered out; however, a defective switch can bypass these filters and output multiple signals for a single key press.

- A mechanical switch, being mechanical and generally filled with springs and thin metal, will tend to bounce around several times making and breaking electrical contact before coming to rest. This often ranges up to 5ms.

- The firmware designer of the keyboard controller takes this into account and sets the scanning rate high enough that keys are being reported accurately but low enough that multiple erroneous key presses aren't sent to the PC.

4.7 MOUSE INTERFACING:

- To transmit their input, typical cabled mice use a thin electrical cord terminating in a standard connector, such as RS-232C, PS/2, ADB or USB. Cordless mice instead transmit data via infrared radiation or radio (including Bluetooth), although many such cordless interfaces are themselves connected through the aforementioned wired serial buses. While the electrical interface and the format of the data transmitted by commonly available mice is currently standardized on USB, in the past it varied between different manufacturers.

- A bus mouse used a dedicated interface card for connection to an IBM PC or compatible computer. Mouse use in DOS applications became more common after the introduction of the Microsoft

mouse, largely because Microsoft provided an open standard for communication between applications and mouse driver software. Thus, any application written to use the Microsoft standard could use a mouse with a Microsoft compatible driver (even if the mouse hardware itself was incompatible with Microsoft's).

- An interesting footnote is that the Microsoft driver standard communicates mouse movements in standard units called "mickeys", as does the Allegro library.

Serial interface and protocol:

- Standard PC mice once used the RS-232C serial port via a D-subminiature connector, which provided power to run the mouse's circuits as well as data on mouse movements.

The Mouse Systems Corporation version used a five-byte

protocol and supported three buttons. The Microsoft version used a three-byte protocol and supported two buttons. Due to the incompatibility between the two protocols, some manufacturers sold serial mice with a mode switch: "PC" for MSC mode, "MS" for Microsoft mode.

PS/2 interface and protocol:

- With the arrival of the IBM PS/2 personal-computer series in 1987, IBM introduced the eponymous PS/2 interface for mice and keyboards, which other manufacturers rapidly adopted.
- The most visible change was the use of a round 6-pin mini-DIN, in lieu of the former 5- pin connector. In default mode (called stream mode) a PS/2 mouse communicates motion, and the state of each button, by means of 3-byte packets.
- A Microsoft IntelliMouse relies on an extension of the PS/2 protocol: the ImPS/2 or IMPS/2 protocol (the abbreviation combines the concepts of "IntelliMouse" and "PS/2"). It initially operates in standard PS/2 format, for backwards compatibility.
- After the host sends a special command sequence, it switches to an extended format in which a fourth byte carries information about wheel movements. The IntelliMouse Explorer works analogously, with the difference that its 4-byte packets also allow for two additional buttons (for a total of five). Mouse vendors also use other extended formats, often without providing public documentation. The Typhoon mouse uses 6- byte packets which can appear as a sequence of two standard 3-byte packets, such that an ordinary PS/2 driver can handle them. For 3-D (or 6-degree-of-freedom) input, vendors have made many extensions both to the hardware and to software.
- In the late 1990s Logitech created ultrasound-based tracking which gave 3D input to a few millimetres accuracy, which worked well as an input device but failed as a profitable product. In 2008, Motion4U introduced its "OptiBurst" system using IR tracking for use as a Maya (graphics software) plugin.

USB:

- The industry-standard USB (Universal Serial Bus) protocol and its connector have become widely used for mice; it's

currently among the most popular types.

Cordless or wireless:

- Cordless or wireless mice transmit data via infrared radiation or radio (including Bluetooth). The receiver is connected to the computer through a serial or USB port, or can be built in (as is sometimes the case with Bluetooth).
- Modern non-Bluetooth wireless mice use USB receivers. Some of these can be stored inside the mouse for safe transport while not in use, while other, newer mice use newer "nano" receivers, designed to be small enough to remain plugged into a laptop during transport, while still being large enough to easily remove.

4.8 PRINTERS (TYPES, OPERATION AND TROUBLESHOOTING)

- A printer is an external output device that takes data from a computer and generates output in the form of graphics / text on a paper. There are two types of printers.

Impact Printers:

- An impact printer makes contact with the paper. It usually forms the print image by pressing an inked ribbon against the paper using a hammer or pins. Following are some examples of impact printers.

Dot-Matrix Printers:

- The dot-matrix printer uses print heads containing from 9 to 24 pins. These pins produce patterns of dots on the paper to form the individual characters.
- The 24 pin dot-matrix printer produces more dots that a 9 pin dot-matrix printer, which results in much better quality and clearer characters.

The general rule is:

- The more pins, the clearer the letters on the paper. The pins strike the ribbon individually as the print mechanism moves across the entire print line in both directions, i-e, from left to right, then right to left, and so on. The user can produce a color output with a dot-matrix printer (the user will change the black ribbon with a ribbon that has color stripes). Dot-matrix printers are inexpensive and typically print at speeds of 100-600 characters per second.

Daisy-Wheel Printers:

- In order to get the quality of type found on typewriters, a daisy-wheel impact printer can be used.

It is called daisy-wheel printer because the print mechanism looks like a daisy; at the end of each "Petal" is a fully formed character which produces solid-line print. A hammer strikes a "petal" containing a character against the ribbon, and the character prints on the paper. Its speed is slow typically 25-55 characters per second.

Line Printers:

- In business where enormous amount of material are printed, the character-at-a-time printers are too slow; therefore, these users need line-at-a-time printers.
- Line printers, or line-at-a-time printers, use special mechanism that can print a whole line at once; they can typically print the range of 1,200 to 6,000 lines per minute. Drum, chain, and band printers are line-at-a-time printers.

Drum Printer:

- A drum printer consists of a solid, cylindrical drum that has raised characters in bands on its surface. The number of print positions across the drum equals the number available on the page. This number typically ranges from 80- 132 print positions.
- The drum rotates at a rapid speed. For each possible print position there is a print hammer located behind the paper.
- These hammers strike the paper, along the ink ribbon, against the proper character on the drum as it passes. One revolution of the drum is required to print each line. This means that all characters on the line are not printed at exactly the same time, but the time required to print the entire line is fast enough to call them line printers.
- Typical speeds of drum printers are in the range of 300 to 2000 lines per minute.

Chain Printers:

- A chain printer uses a chain of print characters wrapped around two pulleys. Like the drum printer, there is one hammer for each print position. Circuitry inside theprinter detects when the correct character appears at the desired print location on the page.
- The hammer then strikes the page, pressing the paper against a ribbon and the character located at the desired print position. An impression of the character is left on the page.
- The chain keeps rotating until all the required print positions on the line have filled. Then the page moves up to print the next line. Speeds of chain printers range from 400 to 2500 characters per minute.

Band Printers:

- A band printer operates similar to chain printer except it uses a band instead of a chain and has fewer hammers. Band printer has a steel band divided into five sections of 48 characters each. The hammers on a band printer are mounted on a cartridge that moves across the paper to the appropriate positions. Characters are rotated into place and struck by the hammers. Font styles can easily be changed by replacing a band or chain.

Non-Impact Printers:

- Non-impact printers do not use a striking device to produce characters on the paper; and because these printers do not hammer against the paper, they are much quieter. Following are some non-impacted printers.

Ink-Jet Printers:

- Ink-jet printers work in the same fashion as dot-matrix printers in the form images or characters with little dots. However, the dots are formed by tiny droplets of ink. Ink- jet printers form characters on paper by spraying ink from tiny nozzles through an electrical field that arranges the charged ink particles into characters at the rate of approximately 250 characters per second.
- The ink is absorbed into the paper and dries instantly. Various colors of ink can also be used. One or more nozzles in the print head emit a steady stream of ink drops.
- Droplets of ink are electrically charged after leaving the nozzle. The droplets are then guided to the paper by electrically charged deflecting plates [one plate has positive charge (upper plate) and the other has negative charge (lover plate)].
- A nozzle for black ink may be all that's needed to print text, but full-color printing is also possible with the addition of needed to print text, but full-color printing is also possible with the addition three extra nozzles for the cyan, magenta, and yellow primary colors.
- If a droplet isn't needed for the character or image being formed, it is recycled back to its input nozzle. Several manufacturers produce color ink-jet printer. Some of these printers come with all their color inks in a cartridge; if you want to replace on color, you must replace all the colors. Other color ink-jet printers allow you to replace ink individually. These printers are a better choice if user uses one color more than other colors. These printers produce less noise and print in better quality with greater speed.

Laser Printers:

- A laser printer works like a photocopy machine. Laser printers produce images on paper by directing a laser beam at a mirror which bounces the beam onto a drum. The drum has a special coating on it to which toner (an ink powder) sticks.
- Using patterns of small dots, a laser beam conveys information from the computer to a positively charged drum to become neutralized. From all those areas of drum which become neutralized, the toner detaches. As the paper rolls by the drum, the toner is transferred to the paper printing the letters or other graphics on the paper.
- A hot roller bonds the toner to the paper. Laser printers use buffers that store an entire page at a time. When a whole page is loaded, it will be printed. The speed of laser printers is high and they print quietly without producing much noise.

- Many home- use laser printers can print eight pages per minute, but faster and print approximately 21,000 lines per minute, or 437 pages per minute if each page contains 48 lines. When high speed laser printers were introduced they were expensive. Developments in the last few years have provided relatively low-cost laser printers for use in small businesses.

Printer troubleshooting:

To troubleshoot your printing problems, start by trying the following:

1. In the application from which you want to print, from the *File* menu, choose *Print*. In the box that appears, check to see which printer the application is trying to access. Make sure that this is the printer you want to use.
2. Try printing something from another application. If you cannot print from another application, you may need to get a new printer driver.
3. The problem could also be specific to the program you are using. If so, try checking online support for that particular vendor's program.

Following are some common issues:

Inkjet printers	
Problem	Possible cause
Prints garbage	This usually happens because the wrong printer driver is installed.
No response from printer; computer gives error message	Check that cables are properly connected and look for an Online or Select button to press on the printer. Many PC printers require an IEEE 1284 cable, which is different from the standard bidirectional parallel cable. Likewise, printers for older Macs require either a serial cable or a LocalTalk cable. Consult your manual to find out what cabling you need.
Print head cannot travel its full horizontal distance	Open the cover and make sure there is nothing obstructing the movement of the print head. Obstructions can result if you haven't removed some of the packaging, or if there is a paper jam. If this is a new printer, remember that you must remove the safety tape, which is put there to prevent the print head from slamming back and forth during shipping.
Acts like it is printing but puts no ink on the page	There is no ink cartridge installed. In many cases, this is a separate item from the print head assembly, which is already installed in the printer from the factory.
Text has wrong print attributes (e.g., bold text not printed as bold)	This usually happens because the wrong printer driver is installed. See information above about drivers.
Parts of characters missing, or characters not correct color	The ink cartridge is either either clogged or running out of ink. Run the software cleaning utility (almost always accessible from the printer) in order to fix a clog. Replace the ink cartridge if the clog cannot be fixed or if the cartridge is almost empty.
Text is faded	One or more of the inkwells in the print cartridge is almost empty. Unless your printer's ink cartridge can have individual colors replenished, this usually means you need to replace the whole cartridge.

Printout is smeared	The paper is mismatched to the paper setting for the printer. For example, if you are using high-quality photo paper, set the printer's output for that paper; do not use the plain paper setting.
Paper jams often	The feeder bin or tray may be overloaded; remove some paper. Excess humidity may be causing pages to stick together; in that case, remove all sheets and use only as much as needed. The paper may have already been through the printer; the feeding process tends to warp and thicken areas of the page by bunching it up. Try not to use paper that's already been fed through the printer.

Laser printers	
Problem	Possible cause
Prints garbage	This is usually the result of a wrong or corrupt printer driver, such as a PostScript driver on a non-PostScript printer.
Refuses to print	Check cables and front panel settings. Make sure the printer is selected or online. Also, many PC printers require an IEEE 1284 cable, which is different from the standard bidirectional parallel cable. Likewise, printers for older Macs require either a LocalTalk or a serial cable. The user manual will specify what cabling is required.
Letters jumble together	This usually happens because the font is unavailable.
Printing takes a long time; often only half of a page prints	The printer is trying to print text in graphics mode. Put a font change code at the beginning of the document for a font that exists on the printer.
Printing is smeared, or there are faint lines on the page	The fuser may be dirty or broken. This may require replacement.
Printing is faded	The fuser is probably almost empty. You may be able to prolong its life by shaking it. If not, replace it.

Short Question

1- what is laser printer?

Ans:- •A laser printer works like a photocopy machine. Laser printers produce images on paper by directing a laser beam at a mirror which bounces the beam onto a drum. The drum has a special coating on it to which toner (an ink powder) sticks**.**

2-What is Flash Memory?

Ans:-Flash memory is a type of erasable read-only memory (EEPROM) that clears and rewrites data in chunks for fast, energy-efficient access and rewriting. Flash memory, or flash storage, is non-volatile, which means it remains viable even without an active power source. Although technically a type of read-only memory (ROM), flash memory is distinct from conventional ROM in that you can edit it as well as read it.

3-What is Primary partition ?

Ans:- A primary partition contains one file system. In DOS and all early versions of Microsoft Windows systems, Microsoft required what it called the system partition to be the first partition. All Windows operating systems from Windows 95 onwards can be located on (almost) any partition, but the boot files (io.sys, bootmgr, ntldr, etc.) must reside on a primary partition .

4-**Define FAT**

Ans:-FAT (File Allocation Table) is one of the simplest file system types, which has been around since the 1980s. It consists of the file system descriptor sector (boot sector or superblock), the file system block allocation table (referred as the File Allocation Table) and plain storage space for storing files and folders.

Long Question

1-Explain the different types of printer and their trouble shootings.
2-Explain the keyboard interfacing and their different keys.
3-Explain the memory and types and differentiate between them.
4. Describe Hard Disk Construction and its working principle.[2020(w)]

CHAPTER -5

DISPLAY, POWER SUPPLY AND BIOS

5.1 DISPLAY AND GRAPHICS CARD
5.2 LCD, PLASMA, TFT, LED DISPLAYS
5.3 SMPS
5.4 BIOS
5.5 POST

5.1 DISPLAY AND GRAPHICS CARD

DISPLAYS:

A display device is an output device for presentation of information in visual or tactile form (the latter used for example in tactile electronic displays for blind people). When the input information that is supplied has an electrical signal the display is called an electronic display.

These are the technologies used to create the various displays in use today.

- Cathode ray tube display (CRT)
- Light-emitting diode display (LED)
- Electroluminescent display (ELD)
- Electronic paper, E Ink
- Plasma display panel (PDP)
- Liquid crystal display (LCD)
- High-Performance Addressing display (HPA)
- Thin-film transistor display (TFT)
- Organic light-emitting diode display (OLED)
- Digital Light Processing display (DLP)
- Surface-conduction electron-emitter display (SED) (experimental)
- Field emission display (FED) (experimental)
- Laser TV (forthcoming)
- Carbon nanotubes (experimental)
- Quantum dot display (QLED)
- Interferometric modulator display (IMOD)
- Digital microshutter display (DMS)
- microLED (in development)

5.2 LCD, PLASMA, TFT, LED DISPLAYS

LCD:

- A liquid crystal display or LCD draws its definition from its name itself. It is a combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image.
- Liquid crystal displays are super-thin technology display screens that are generally used in laptop computer screens, TVs, cell phones, and portable video games. LCD's technologies allow displays to be much thinner when compared to a cathode ray tube (CRT) technology.
- Liquid crystal display is composed of several layers which include two polarized panel filters and electrodes. LCD technology is used for displaying the image in a notebook or some other electronic devices like mini computers.
- Light is projected from a lens on a layer of liquid crystal. This combination of colored light with the grayscale image of the crystal (formed aselectric current flows through the crystal) forms the colored image. This image is then displayed on the screen.

PLASMA:

- A plasma display panel (PDP) is a type of flat panel display often used for large television displays (typically above 37 inches or 940 millimeters (mm)). Many tiny cells located between two panels of glass hold an inert mixture of noble gases (neon and xenon). The gas in the cells is electrically turnedinto a plasma, which then excites phosphors to emit light.
- Plasma displays should not be confused with LCDs (liquid crystal displays), which are also lightweight, flat screen displays but are produced by a very different technology. The xenon and neon gas mixture in a plasma television is contained in hundreds of thousands of tiny cells positioned between two plates of glass.
- In color panels, the back of each cell is coated with a phosphor. Ultraviolet photons emitted by the plasma excite these phosphors to give off colored light.
- The operation of each cell is thus comparable to that of a fluorescent lamp.
- Every pixel is made up of three separate subpixel cells, each with different colored phosphors. One subpixel has a red light phosphor, another has a green light phosphor, and a third has a blue light phosphor. These colors blend together to create the overall color of the pixel, analogous to the "triad" of a shadow-mask CRT.

TFT:

- As a display device TFT stands for Thin Film Transistor and is used to enhance the operation and usefulness of LCD displays.
- An LCD is a fluidic display device that uses a crystalline filled liquid to manipulate a rear illumination polarized source by means of an electrostatic field between two thin transparent metal conductors such as indium tin oxide (ITO) in order to

present an image to the viewer.

- This process can be used in both segmented or pixelated display devices but is found synonymous with color TFT displays.
- When an LCD is used to display moving images the inherent slow rate of change between fluid states over a large number of pixel elements can be a problem due in part to capacitive effects, which causes moving image blurring.
- By putting a high speed LCD controlling device in the form of a thin film transistor right at the pixel element on the glass surface, the LCD image speed issue can be greatly enhanced and for all practical purposes eliminates image blurring. Other benefits of these thin film transistors are they allow for thinner display designs and different pixel designs and arrangements to vastly improve display viewing angles.
- TFT displays are found in many applications these days, from mobile devices, appliance, medical devices, instrumentation, aircraft and certainly computer display devices as well as TV's. The addition of the thin film transistor in LCD design vastly improved the use of LCD's in all market areas.

LED:

- A LED screen is a video display which uses light- emitting diodes. An LED panel is a small display, or a component of a larger display or screen.
- They are typically used outdoors in store signs and billboards, and in recent years have also become commonly used in destination signs on public transport vehicles.
- LED panels are sometimes used as form of lighting, for the purpose of general illumination, task lighting, or even stage lighting rather than display.

Types of LED Screens:

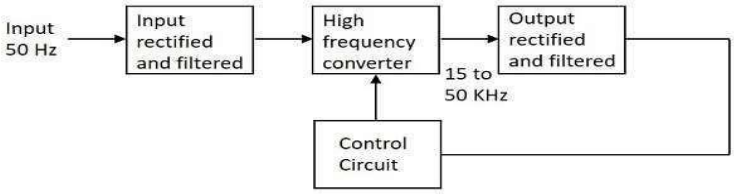
- There are two types of LED panels: conventional (using discrete LEDs) and surface-mounted device (SMD) panels. Most outdoor screens and some indoor screens are built around discrete LEDs, also known as individually mounted LEDs. A cluster of red, green, and blue diodes is driven together to form a full-color pixel, usually square in shape.
- These pixels are spaced evenly apart and are measured from center to center for absolute pixel resolution. The largest LED display in the world is over 1,500 foot (457.2 m) long and is located in Las Vegas, Nevada covering the Fremont Street Experience. The largest LED television in the world, the Center Hung Video Display at Cowboys Stadium

5.3 SMPS (BASIC PRINCIPLES AND OPERATIONS, O/P VOLTAGE)

SMPS:

Wire colour	DC Voltage
Red	+5 V
Yellow	+12V
Black	Ground
Blue	-12V
Grey	Power Good
Green	Power On
Purple	+5V Standby
Orange	+3.3V
Brown/Orange	+3.3V Sense
White	-5V (optional)

- SMPS or switched mode power supply is an electronics device that is used to convert AC to DC, AC to AC, DC to DC and DC to AC voltages.



- The circuit consists of transformer, rectifier, voltage regulator and a filter. The input supply is turned On and Off by MOSFETs and outputs a high efficiency, regulated voltage. The SMPS used in computers is of AC to DC type supply.

SMPS parts and Connectors:

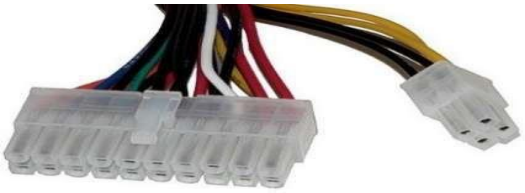
Power-IN. The power-IN connector as shown in the figure is the input for MAINS supply. A power cable is inserted here, the other end of which is connected to mains supply. The input supply gets converted to DC supply.

Power-OUT. The power-OUT connector is connected directly to the Power-IN connector from inside the supply unit. It supplies the same AC supply that is fed to power-IN socket. The power-OUT connector is used to give supply to monitors or any display unit.

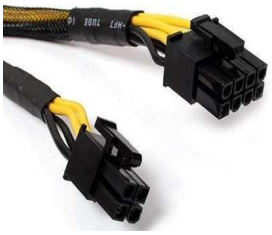
FAN. If you look at the back side of Computer-SMPS, you will find a FAN at the right side. The FAN as you can see, blows the air out and is only used to dissipate the internal heat from the SMPS since the switching is done at high frequencies which create a lot of heat inside.

POWER CONNECTORS:

- All computer power supply connectors have a fool proof design such that they can only be connected in a single direction (so there's no way to mess up here). And while a power supply looks like a big mess of cables to the untrained eye, there's only a few types of PC power connectors that you'll need to know when connecting a power supply.
- **(20+4 Pin) ATX Power Connector:**



The primary task of the Power Supply Unit (PSU) is to provide your motherboard with power. This is done via the 20-pins or 24-pins connector. A 24-pins cable is backwards compatible with a 20-pins motherboard, often this cable can be split into 20- and 4-pins (like in the image above).



- **P4 (EPS Connector):** At some point in time the motherboard's pins were no longer sufficient to provide the processor (cpu) with power. With overclocked cpu's drawing as much as 200W a need to provide power directly to the CPU was created. Nowadays it is the P4, or EPS connector, to provide the cpu with power.
- Cheap motherboards are equipped with a 4-pins connector. More expensive "overclocking" motherboards have 8-pin connectors. The extra 4 pins ensure that enough power can be provided to the cpu when overclocking. For regular usage there is absolutely no need for the additional pins. Most PSU's provide two cables; one with 4-pins and one with 8-pins. Obviously you only need to use one of these cables. It is also possible that your 8-pin cable can be split into two segments to provide backwards compatibility with cheaper motherboards.

- **PCI-E Connector (6-pin en 6+2 pin):** The motherboard can provide a maximum of 75W through its PCI-E interface slot. Faster dedicated graphics cards require much more power. To solve that issue the PCI-E connector was introduced. The PCI-E 6-pin connector can supply an additional 75W per cable. So if your Graphic card contains a single 6-pin connectors it can draw up to 150W (75W from the motherboard + 75W from the cable). More expensive graphic cards require the 6+2 pin PCI-E connector. With it's 8 pins this connector can provide up to 150W per cable. A graphics card with a single 6+2-pin connector can draw up to 225W (75W from the motherboard + 150W from the cable).
- **Molex (4 Pin Peripheral Connector):** Molex connectors have been around for a very long time and can deliver 5V (red) or 12V (Yellow) to hardware peripherals. In the past these guys were

often used to connect Hard drives, CD-ROM players, etc. Even some graphics cards

like the Geforce 7800 GS were equipped with Molex. However their power draw is limited so nowadays most of their purpose has been replaced by PCI-E cables and SATA cables. All that is left is powering case fans. Thanks to its angular side you cannot go wrong when connecting a Molex cable. Keep in mind that they can be extremely difficult to detach.

SATA Connector:

- The SATA connector is the guy that made the Molex obsolete. All modern DVD-players, hard disk drives and SSD's are powered by SATA power.

- **Mini-Molex / Floppy connector:**

Completely obsolete, but some PSU's still come with a mini-molex connector. These guys were used to power floppy disk drives. For those of you who do not remember; these were square magnetic disks that could contain up to 1.44 MB of data.

Basically they were superseded by the USB stick.

- **Adapter: Molex to SATA Power cable:** Old power supply unit or simply lacking the required number of SATA power connectors? Use a Molex to SATA connector to power your latest hard disk drive.

- **Adapter: Molex to PCI-E 6-pins:** Need another PCI-6 pin cable to power your graphics card? Use the "2x Molex to 1x PCI-E 6-pin" adapter. Please make sure you connect both molex to different cable strains. This reduces the risk of overloading your power supply. If you don't 75W will flow through your Molex cable.

5.4 BIOS (FUNCTIONS, SETUPS, TYPES OF BIOS):

- Stands for "Basic Input/Output System." Most people don't need to ever mess with the BIOS on a computer, but it can be helpful to know what it is. The BIOS is a program pre-installed on Windows-based computers (not on Macs) that the computer uses to start up.

- The CPU accesses the BIOS even before the operating system is loaded. The BIOS then checks all your hardware connections and locates all your devices. If everything is OK, the BIOS loads the operating system into the computer's memory and finishes the boot-up process. Since the BIOS manages the hard drives, it can't reside on one, and since it is available before the computer boots

up, it can't live in the RAM. So where can this amazing, yet elusive BIOS be found? It is actually located in the ROM (Read-Only Memory) of the computer.

- More specifically, it resides in an erasable programmable read-only memory (EPROM) chip. So, as soon as you turn your computer on, the CPU accesses the EPROM and gives control to the BIOS. The BIOS also is used after the computer has booted up. It acts as an intermediary between the CPU and the I/O (input/output) devices. Because of the BIOS, your programs and your operating system don't have to know exact details (like hardware addresses) about the I/O devices attached to your PC.

- When device details change, only the BIOS needs to be updated. You can make these changes by entering the BIOS when your system starts up. To access the BIOS, hold down the DELETE or F2 key as soon as your computer begins to start up.

FOUR MAIN FUNCTIONS OF BIOS:

- POST - Test the computer hardware and make sure no errors exist before loading the operating system. Additional information on the POST is available on our POST and beep codes page.
- Bootstrap Loader - Locate the operating system. If a capable operating system is located, the BIOS will pass control to it.
- BIOS drivers - Low-level drivers that give the computer basic operational control over your computer's hardware.
- BIOS setup or CMOS setup - Configuration program that allows you to configure hardware settings including system settings, such as computer passwords, time, and date.

HOW TO USE BIOS

BIOS supports several hardware configurations options that can be changed through the setup utility. Saving these changes and restarting the computer applies the changes to the BIOS and alters the way BIOS instructs the hardware to function.

Here are some common things you can do in most BIOS systems:

- Change the Boot Order
- Load BIOS Setup Defaults
- Flash (Update) BIOS
- Remove a BIOS Password
- Create a BIOS Password
- Change the Date and Time
- Change Floppy Drive Settings
- Change Hard Drive Settings
- Change CD/DVD/BD Drive Settings
- View Amount of Memory Installed
- Change the Boot Up NumLock Status
- Enable or Disable the Computer

Logo

- Enable or Disable the Quick Power On Self Test (POST)
- Enable or Disable the CPU Internal Cache
- Enable or Disable the Caching of BIOS
- Change CPU Settings
- Change Memory Settings
- Change System Voltages
- Enable or Disable RAID
- Enable or Disable Onboard USB
- Enable or Disable Onboard IEEE1394
- Enable or Disable Onboard Audio
- Enable or Disable Onboard Floppy Controller
- Enable or Disable Onboard Serial/Parallel Ports
- Enable or Disable ACPI
- Change the ACPI Suspend Type
- Change the Power Button Function
- Change Power-on Settings
- Change Which Display is Initialized First on Multi-Display Setups
- Reset Extended System Configuration Data (ESCD)

- Enable or Disable BIOS Control of System Resources
- Change Fan Speed Settings
- View CPU and System Temperatures
- View Fan Speeds
- View System Voltages

TYPES OF BIOS:

There are two different types of BIOS –

- UEFI – UEFI (Unified Extensible Firmware Interface) can accommodate 2.2 TB or larger drives by using the Master Boot Record (MBR) approach in place of the more modern GUID Partition Table (GPT) technology. Although Intel PCs migrate away from Legacy BIOS and towards UEFI firmware, BIOS has never been used by Apple's Mac PCs.
- Legacy BIOS – Older motherboards have legacy firmware on the BIOS to turn the PC on. Although it governs how the CPU and the components communicate, like UEFI, Legacy BIOSes have other limitations. These can't identify drives bigger than 2.1 TB, and their setup programs have text-only menus.

5.5 POST (OPERATION, FAULTS RELATED TO HARDWARE)

- POST, short for Power On Self Test, is the initial set of diagnostic tests performed by the computer right after it's powered on, with the intent to check for any hardware related issues. Computers aren't the only devices that run a POST.
- Some appliances, medical equipment, and other devices also run very similar self-tests after being powered on.

THE ROLE OF POST IN THE START-UP PROCESS

- A Power On Self Test is the first step of the boot sequence. It doesn't matter if you've just restarted your computer or if you've just powered it on for the first time in days; the POST is going to run, regardless.
- POST doesn't rely on any specific operating system. In fact, there doesn't even need to be an OS installed on a hard drive for the POST to run.
- This is because the test is handled by the system's BIOS, not any installed software. A Power On Self-Test checks that basic system devices are present and working properly, like the keyboard and other peripheral devices, and other hardware elements like the processor, storage devices, and memory.
- The computer will continue to boot after the POST but only if it was successful. Problems can certainly appear after the POST, like Windows hanging during startup, but most

of the time those can be attributed to an operating system or software problem, not a hardware one. If the POST finds something wrong during its test, you'll usually get an error of some kind, and hopefully, one clear enough to help jump-start the troubleshooting process.

PROBLEMS DURING THE POST

- Remember that the Power On Self Test is just that: a self-test. Just about anything that might prevent the computer from continuing to start will prompt some kind of error. Errors might come in the form of flashing LEDs, audible beeps, or error messages on the monitor, all of which are technically referred to as POST codes, beep codes, and on-screen POST error messages, respectively.

- If some part of the POST fails, you'll know very soon after powering on your computer, but how you find out depends on the type, and severity, of the problem. For example, if the problem lies with the video card, and therefore you can't see anything on the monitor, then looking for an error message wouldn't be as helpful as listening for a beep code or reading a POST code with a POST test card.

- On macOS computers, POST errors often appear as an icon or another graphic instead of an actual error message. For example, a broken folder icon after starting up your Mac may mean that the computer can't find a suitable hard drive to boot from. Certain types of failures during the POST might not produce an error at all, or the error may hide behind a computer manufacturer's logo. Since issues during the POST are so varied, you may need a troubleshooting guide specific to them.

POST TROUBLESHOOTING STEPS

If you're experiencing POST errors when you boot your computer, the following steps may help you fix the problem.

Remove new hardware: If any new hardware was recently added to the computer, remove that hardware to make sure it is not causing your issue. If your computer works after removing the new hardware, it can mean a few things. Either the new hardware is not compatible with your computer, a system setting needs to be changed, or the new hardware is defective.

Remove any disks or USB devices: Remove any disks, CDs, or DVDs that are in the computer. If any USB devices (iPods, drives, phones, etc.) are connected, disconnect all of them as well. Reboot the computer and see if anything changes.

Disconnect external devices: Remove everything from the back of the computer, except the power cable. Turn on the computer and see if it beeps normally. If the computer has never beeped, keep the monitor or display connected to see if any change occurs.

Reconnect and check power cords: If the computer is not getting enough power or the power is getting interrupted, the computer can encounter problems. Disconnect your power cables from any power strip or UPS (uninterruptible power supply) and connect the computer directly to a known good wall outlet.

Identify beep code: If you are receiving a sequence of beeps, see the beep code page for a listing of different beep codes and their explanation. You can also check your motherboard or computer documentation for information on the beep codes. These beep codes are meant to help identify which computer component is failing or bad. If your beep code is not listed, continue troubleshooting.

Check all fans: Make sure all fans are running on the computer. If a fan has failed (especially the heat sink fan for the CPU), your computer could be overheating or detecting the fan failure, causing the computer not to boot.

Check all cables: Verify all the cables are securely connected to the computer and that there are no loose cables by firmly pressing in each cable.

- All disk drives should have a data cable and power cable connected to them.
- Your power supply should have at least one cable going to the motherboard. Many motherboards may also have additional cables connected to them to supply power to the fans.

Disconnect all expansion cards: If the above recommendations still have not resolved the irregular POST, disconnect the riser board (if applicable) and each of the expansion cards. If this fixes the problem or allows the computer to POST, connect one card at a time until you determine which card is causing the problem.

Disconnect all drives: If you cannot diagnose the problem by the beep code (or you do not hear a beep code), power off the computer. Then, disconnect any IDE, SATA, SCSI, or other data cables from the motherboard. When they are disconnected, try booting the computer again. If this resolves your irregular POST or generates error messages, reconnect each device until you determine which device or cable is causing the issue. In some situations, it can also be a loose cable connection that causes the issue.

Remove the RAM:

- If you continue to experience the same problem with all the above hardware removed, remove the RAM from the motherboard and turn on the computer. If the computer has a different beep code or was not beeping but is now, turn off your computer and try the suggestions below.

- Make sure to turn off the computer before adding and removing the memory and then turning it back on to see if the suggestion resolves the issue.

1. Re-insert the memory into the same slot.
2. If you have more than one stick of memory, remove all but one stick of memory and try rotating through each stick.
3. Try one stick of memory in each slot.

If you can get the computer to boot with one or more of the sticks of memory installed, you are likely dealing with some bad memory. Try to identify which stick of memory is bad and replace it. If you can get the memory to work in one slot but not another slot, the motherboard is likely defective. You can either workaround the issue by running the memory in a different slot that does work or replace the motherboard.

Power cycle the computer: In some situations, a computer may have power related issues often caused by either the power supply or the motherboard. To help determine if this is the issue, try turning the computer on, off, and back on as fast as possible, making sure the computer power light goes on and off. In some situations, you may get the computer to boot.

Disconnect and reconnect the CPU: For users who're more comfortable working inside their computer, reseat the CPU by removing it and re-inserting it into the socket. You should also apply a fresh layer of thermal compound between the CPU and the heat sink.

Loose BIOS chip: If your motherboard has a BIOS chip, it can become loose over time due to heat expansion and cause the computer to give an irregular POST. Gently press down on the BIOS chip to make sure it has not become loose.

Bad motherboard, CPU, RAM, or power supply:

- If, after trying all of the above recommendations you still have an issue, you likely have a bad motherboard, power supply, CPU, or RAM stick.
- The next step would be either to replace these components or have the computer serviced. If you plan on doing the repairs yourself, we suggest you replace or swap in parts from another computer that is known to work.
  - Replace the motherboard first, then the RAM, the CPU, and finally, the power supply.

Short Question

1- **What is L ED?**

Ans:-A LED screen is a video display which uses light- emitting diodes. An LED panel is a small display, or a component of a larger display or screen.

2. **What is T FT?**

Ans:-As a display device TFT stands for Thin Film Transistor and is used to enhance the operation and usefulness of LCD displays. An LCD is a fluidic display device that uses a crystalline filled liquid to manipulate a rear illumination polarized source by means of an electrostatic field between two thin transparent.

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4. **What is BIOS?[2020(w)]**

Stands for "Basic Input/Output System." Most people don't need to ever mess with the BIOS on a computer, but it can be helpful to know what it is. The BIOS is a program pre-installed on Windows-based computers (not on Macs) that the computer uses to start up.

5. **What is POST?[2020(w)]**

Ans:- A Power On Self Test is the first step of the boot sequence. It doesn't matter if you've just restarted your computer or if you've just powered it on for the first time in days; the POST is going to run, regardless

Long Question

1. **Discuss the different function and operation of SMPS .**
2. **Explain setup types of Basic I/O system.**

6.1 Assembly of Components of Desktop Computers
6.2 Configuring Laptops and Power settings
6.3 Laptop Components(Adapter , Battery, Basic problems, RAM types, CPU types, Laptop Motherboard, block diagram, Laptop Keyboard)
6.4 Formatting , Partitioning and installation of OS
6.5 Troubleshooting of Commonly faced problems in Desktops and Laptops
6.6 Basic Maintenance concepts(Preventive, Corrective, online)
6.7 Diagnostic programs and tools
6.8 Methods of Troubleshooting(symptom observation, analysis, diagnosis, Correction)
6.9 Up gradation of system and application software
6.10 Virus concepts

6.1 Assembly of Components of Desktop Computers

After you have all of the parts and materials needed, it will take between 2 and 4 hours to assemble a computer and you will need to be able to use simple hand tools, such as a screwdriver and a pair of pliers.

6.1.1 Open the case
6.1.2 Install the power supply
6.1.3 Attach the components to the motherboard and install the motherboard
6.1.4 Install internal drives
6.1.5 Install drives in external bays
6.1.6 Install adapter cards
6.1.7 Connect all internal cables
6.1.8 Reattach the side panels and connect external cables to the computer Boot the computer for the first time

Open the Case

Computer assembly is a large part of a technician's job. Prepare the workspace before opening the computer case. There are different methods for opening cases. To learn how, consult the user manual or manufacturer's website.

Install the Power Supply Power supply

installation steps include the following:

1. Insert the power supply into the case
2. Align the holes in the power supply with the holes in case
3. Secure the power supply to the case using the proper screws.

Attach Components to the Motherboard

CPU on Motherboard

- The CPU and motherboard are sensitive to electrostatic discharge.
- The CPU is secured to the socket on the motherboard with a locking assembly.
- **CAUTION:**

When handling a CPU, do not touch the CPU contacts.

Thermal compound

- It helps to keep the CPU cool.
- To install a used CPU, clean it and the base of the heat sink with isopropyl alcohol to remove the old thermal compound.

Heat Sink/Fan Assembly

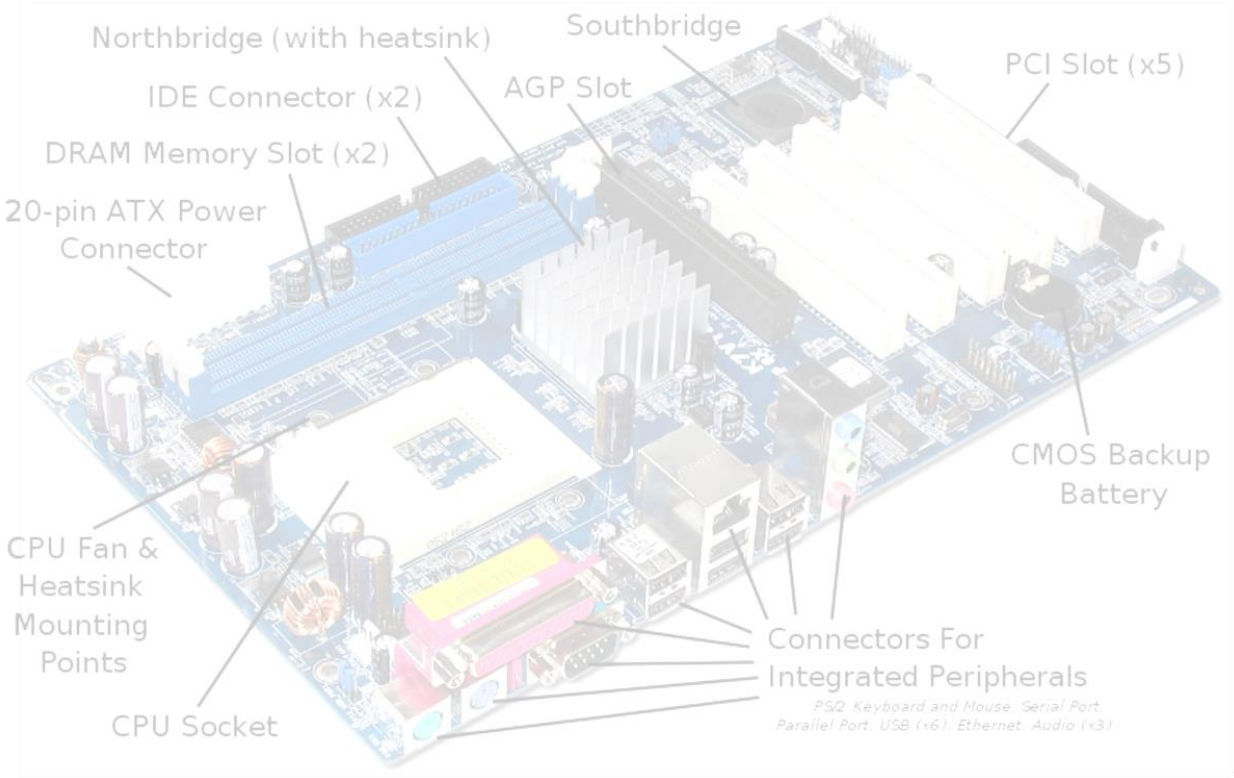
- The Heat Sink/Fan Assembly is a two-part cooling device.
- The heat sink draws heat away from the CPU.

Install RAM

- RAM provides temporary data storage for the CPU and should be installed in the motherboard before the motherboard is placed in the computer case.

The Motherboard

After installing the previous components, the motherboard is now ready to install in the computer case. Plastic and metal standoffs are used to mount the motherboard and to prevent it from touching the metal portions of the case.



Install Internal Drives

Drives that are installed in internal bays are called internal drives.A hard disk drive (HDD) is an example of an internal drive.

HDD installation steps:

1. Position the HDD so that it aligns with the 3.5-inch drive bay.
2. Insert the HDD into the drive bay so that the screw holes in the drive line up with the screw holes in the case.
3. Secure the HDD to the case using the proper screws.

Install Drives in External Bays

Drives in external bays allow access to the media without opening the case. Some devices that are installed in this type of drives are:

- An optical drive is a storage device that reads and writes information to CDs or DVDs.
- A floppy disk drive (FDD) is a storage device that reads and writes information to a floppy disk.

Install Adapter Cards

Adapter cards are installed to add functionality to a computer. Some examples of these adapters are:

- A NIC which enables a computer to connect to a network. It uses PCI and PCIe expansion slots on the motherboard.
- A wireless NIC which enables a computer to connect to a wireless network. Wireless NICs use PCI and PCIe expansion slots on the motherboard. Some wireless NICs are installed externally with a USB connector.
- A video adapter card is the interface between a computer and a display monitor. An upgraded video adapter card can provide better graphic capabilities for games and graphic programs. Video adapter cards use PCI, AGP, and PCIe expansion slots on the motherboard.

Connect Internal Cables

Power cables are used to distribute electricity from the power supply to the motherboard and other components.

- Data cables transmit data between the motherboard and storage devices, such as hard drives. Some of examples of this type of cables are:
  - PATA cable
  - SATA cable
  - Floppy drive data cable

  Additional cables connect the buttons and link lights on the front of the computer case to the motherboard.

Complete Physical Installation

Now that all the internal components and the power supply have been installed and connected to the motherboard, the following tasks should be completed:

•Re-Attach the side panels: Most computer cases have two panels, one on each side. Some computer cases have one three-sided cover that slides down over the case frame.

•Connect External Cables: These cables are normally connected to the back of the computer. Here are some common external cable connections: Monitor, Keyboard, Mouse, USB, Ethernet Power.

Boot Computer for the First Time

- When the computer is booted, the basic input/output system (BIOS) will perform a power-on self test (POST) to check on all of the internal components.
- The BIOS contains a setup program used to configure settings for hardware devices.
- The configuration data is saved to a special memory chip called a complementary metal-oxide semiconductor (CMOS).
- POST checks to see that all of the hardware in the computer is operating correctly. If a device is malfunctioning, an error or a beep code alerts the technician that there is a problem.

6.2 Configuring Laptops and Power settings

Windows 7

1. **Click on "Start."**
2. **Click "Control Panel"**
3. **Click "Power Options"**
4. **Click "Change battery settings"**
5. **Select the power profile you desire**

Windows XP

1. **Click on "Start"**
2. **Go up to "Settings"**
3. **Click on "Control Panel"**
4. **Click on the "Power Options icon" (it is an image of a battery and a power plug)**
5. **Change the Power Schemes drop down to OSU Energy Saver**
6. **Click "OK"**
7. **Close the Control Panel window**

6.3 Laptop Components(Adapter , Battery, Basic problems, RAM types, CPU types, Laptop Motherboard, block diagram, Laptop Keyboard)

Adapter

6.3.1 Laptops are portable devices with their own power supply in the form of a rechargeable battery. These batteries only last for so long before they need to be recharged. Laptops use power adapters that plug into wall outlets for this purpose.

6.3.2 Laptops rely on two main types of power adapters for energy: the AC adapter and the DC Adapter. These adapters, also known as chargers, are what help convert the electricity from the wall outlet into a form that's usable for the laptop.

Battery

6.3.3 Laptops are powered by several different types of batteries. These batteries provide direct-current power to your laptop.

6.3.4 There are currently three types of batteries commonly used for laptops: **Nickel Cadmium, Nickel Metal Hydride, and Lithium Ion**.

Basic problems

1. Problem: **Loud fan or heating up followed by shut down**. Laptops get moved around a lot. This can lead to limiting air intake to the fan. It also gives them plenty of opportunities to drag dust and foreign particles into their cooling system via their fan portal.
    - Solution: Use your laptop on hard, flat surfaces; Avoid putting it on soft surfaces that may block air passage. Clean out your fan with compressed air. Limit how many programs you run at once as well because the more you have running, the harder it has to work.
2. Problem: **Laptop running slowly**. This happens quite often and could be related to hard drive space, malware or the first signs of equipment failure.
    - Solution: There are lots of ways to try to tackle speed issues, but check out our blog post dedicated to just this topic for 10 tips on speeding up your machine.
3. Problem: **Battery doesn't last**. One of the best features of a laptop is that it's wireless. But, we live in constant fear of draining our battery and running out of juice, so we are constantly hard on our battery.
    - Solution: First, check all of your charger cable connections to be sure they are snug. Next, drain your battery completely and recharge it by leaving your laptop on until it dies. One of the greatest fixes of all technology is simply to fully drain the energy from it and try again, the computer equivalent of a good night's sleep. If it still fails far sooner than it should, you may need to replace the battery itself.
4. Problem: **No internet**. Laptops are notorious for losing connection to the internet, which can be a major hassle. Before assuming some sort of equipment failure, try some basic steps.

- Solution: On most laptops, there is an actual wireless button or switch to activate the connection, find it and make sure it's in the ON position. Then re-boot your router, again using the drain the power tactic; unplug your router, let all the juice drain out for 10-20 seconds, then plug it back in. If you're still having trouble, troubleshoot your network connections in your control panel. Finally, re-build your network from the beginning to make sure all your connections are set up

properly.

5. Black Screen. **You open up your laptop, power it on, hear it running, but the screen is black.**

- Solution: Unplug the power, remove the battery and then hold the power button for 30 to 60 seconds. Reattach the power cord and re-boot.
  Then shut down again, put in the battery and re-boot.

RAM types

There are two main types of RAM:

1. Dynamic RAM (DRAM) and
2. Static RAM (SRAM).

CPU types

6.3.5 Intel Core laptops are available in different variants – Dual core, core2 duo, quad core, i3, i5, i7 and i9.

6.3.6 These are designed to complement the different ways we work with our laptops. Finding the best Intel processor for you depends on how you'll use your laptop.

- **FOR EVERYDAY USERS - CORE i3**

If your average use of a laptop extends no further than updating social networks, browsing the web or streaming a movie, a Core i3 should give you enough power.

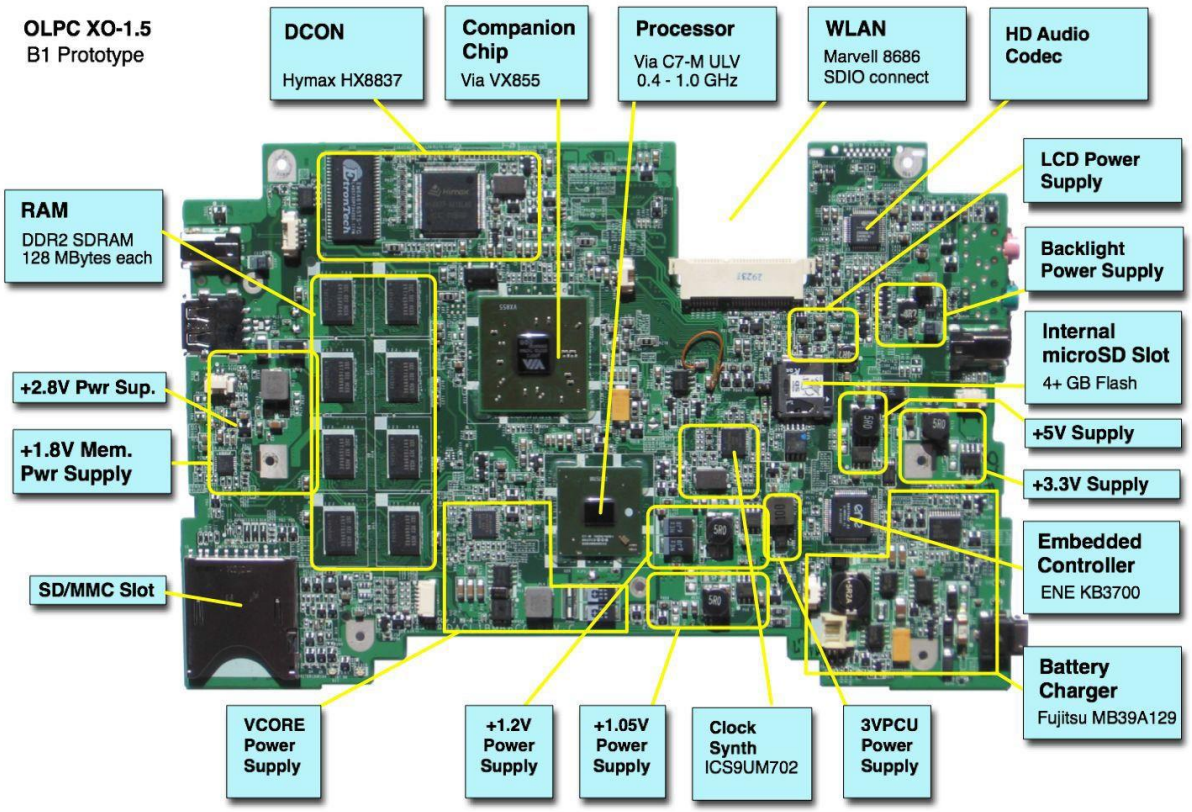
- **FOR MULTITASKING AND RESEARCH - CORE i5**

  For streaming your favourite podcasts and music while you work, or when research takes you down a rabbit-hole of browser tabs. The i5 is built for busy browsing and multitasking.

Laptop Motherboard

A motherboard (also called mainboard, main circuit board, system board, baseboard, planar board, logic board) is the main printed circuit board (PCB) in general-purpose computers and other expandable systems. It holds and allows communication between many of the crucial electronic components of a system, such as the central processing unit (CPU) and memory, and provides connectors for other peripherals.

block diagram



Laptop Keyboard

A typical laptop keyboard layout has typewriter keys, shift keys, function keys, and cursor control keys. ... These include Shift, Alt, Ctrl, and the special Windows keys Win and Context. The Win key appears in the bottom row between the Fn and Alt keys; the Context key appears between Alt and Ctrl.

6.4 Formatting , Partitioning and installation of OS

Formatting a drive prepares the surface of the disk to store new data. Computers are often formatted before they are sold, donated, or returned to employers. Likewise, computers with viruses or errors can be formatted and returned to their "out of the box" settings.

How To Format A Computer With Windows 10

To format your hard disk during Windows 10 installation, you'll need to start, or boot, your computer using the Windows 10 installation disc or USB flash drive.

1. Turn on your computer so that Windows starts normally, insert the Windows 10 installation disc or USB flash drive, and then shut down your computer.
    - If you don't have a Windows 10 Installation USB or CD, you can download and create one from here.
2. Restart your computer.
3. Press any key when prompted, and then follow the instructions that appear.
4. On the "Install Windows" page, enter your language and other preferences, and then click Next.
5. If the "Install Windows" page doesn't appear, and you're not asked to press any key, you might need to change some system settings. To learn how to do this, see Start your computer from a Windows 10 installation disc or USB flash drive.
6. On the "Please read the license terms" page, if you accept the license terms, click I accept the license terms, and then click Next.
7. On the "Which type of installation do you want?" page, click Custom.
8. On the "Where do you want to install Windows?" page, click Drive options (advanced).
9. Click the partition that you want to format and click Format.
    - If you have more than one partition on this hard drive and want to get rid of them to make one big drive again, then select a partition and click on the Delete option for each partition. Once you have deleted all the partitions, select the Unallocated Space partition and click Format.
    - Pick the formatting option that you want.
    - When you've finished formatting, click Next.
10. Follow the instructions to finish installing Windows 10, which include naming your computer and setting up an initial user account.
11. If you do not want to reinstall Windows 10, you can cancel the installation at this point and keep your newly formatted drives.

6.5 Troubleshooting of Commonly faced problems in Desktops and Laptops

Problem-1: Power button will not start computer

6.5.1 Solution 1: If your computer does not start, begin by checking the power cord to confirm that it is plugged securely into the back of the computer case and the power outlet.

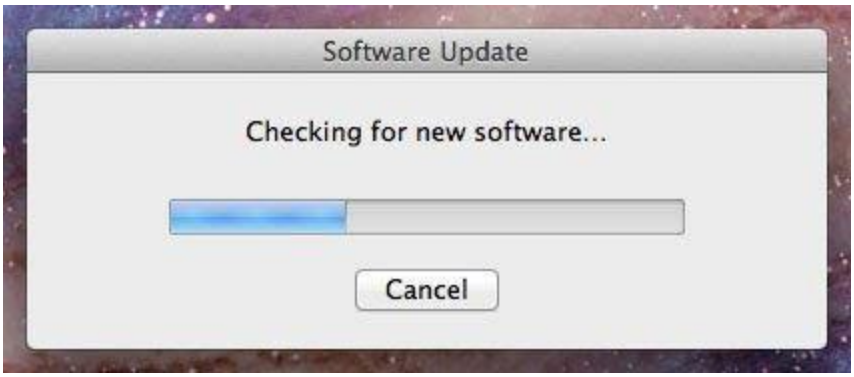
6.5.2 Solution 2: If it is plugged into an outlet, make sure it is a working outlet. To check your outlet, you can plug in another electrical device, such as a lamp.

Problem-2: An application is running slowly

6.5.2.1 Solution 1: Close and reopen the application.

- **Solution 2: Update the application. To do this, click the Help menu and look for an option to check for Updates. If you don't find this option, another idea is to run an online search for**

application updates.



Problem-3: An application is frozen

Sometimes an application may become stuck, or frozen. When this happens, you won't be able to close the window or click any buttons within the application.

- **Solution 1: Force quit the application. On a PC, you can press (and hold) Ctrl+Alt+Delete (the Control, Alt, and Delete keys) on your keyboard to open the Task Manager. On a Mac, press and hold Command+Option+Esc. You can then select the unresponsive application and click End task (or Force Quit on a Mac) to close it.**

- **Solution 2: Restart the computer. If you are unable to force quit an application, restarting your computer will close all open apps.**

Problem-4: All programs on the computer run slowly

- **Solution 1: Run a virus scanner. You may have malware running in the background that is slowing things down.**
- **Solution 2: Your computer may be running out of hard drive space. Try deleting any files or programs you don't need.**
- **Solution 3: If you're using a PC, you can run Disk Defragmenter. To learn more about Disk Defragmenter, check out our lesson on Protecting Your Computer.**

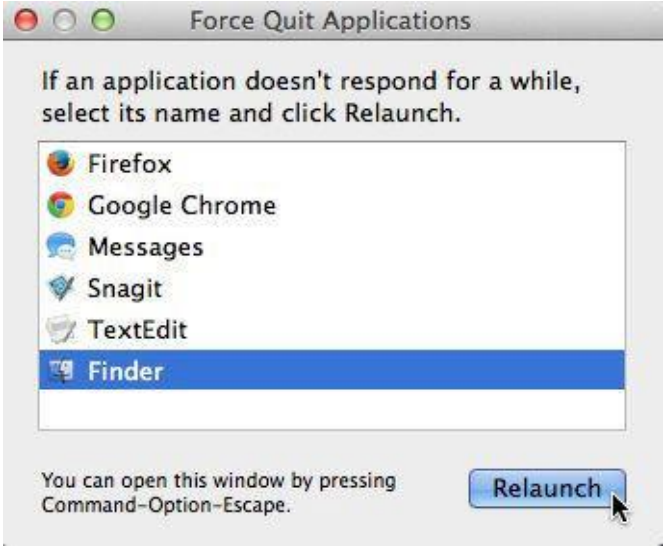
Problem-5: The computer is frozen

Sometimes your computer may become completely unresponsive, or frozen. When this happens, you won't be able to click anywhere on the screen, open or close applications, or access shut-down options.

- **Solution 1 (Windows only): Restart Windows Explorer. To do this, press and hold Ctrl+Alt+Delete on your keyboard to open the Task Manager. Next, locate and select Windows Explorer from the Processes tab and click Restart. You may need to click More Details at the bottom of the window to see the Processes tab.**

- **Solution 2 (Mac only): Restart Finder. To do this, press and hold Command+Option+Esc on your keyboard to open the Force Quit Applications dialog box. Next, locate and select**

Finder, then click Relaunch.



- Solution 3: Press and hold the Power button. The Power button is usually located on the front or side of the computer, typically indicated by the power symbol. Press and hold the Power button for 5 to 10 seconds to force the computer to shut down.
- Solution 4: If the computer still won't shut down, you can unplug the power cable from the electrical outlet. If you're using a laptop, you may be able to remove the battery to force the computer to turn off. Note: This solution should be your last resort after trying the other suggestions above.

Problem-6: The mouse or keyboard has stopped working

- Solution 1: If you're using a wired mouse or keyboard, make sure it's correctly plugged into the computer.
- Solution 2: If you're using a wireless mouse or keyboard, make sure it's turned on and that its batteries are charged.

Problem-7: The sound isn't working

- Solution 1: Check the volume level. Click the audio button in the top-right or bottom-right corner of the screen to make sure the sound is turned on and that the volume is up.

- Solution 2: Check the audio player controls. Many audio and video players will have their own separate audio controls. Make sure the sound is turned on and that the volume is turned up in the player.

- Solution 3: Check the cables. Make sure external speakers are plugged in, turned on, and connected to the correct audio port or a USB port. If your computer has color-coded ports, the audio output port will usually be green.
- Solution 4: Connect headphones to the computer to find out if you can hear sound through the headphones.

Problem-8: The screen is blank

- **Solution 1: The computer may be in Sleep mode. Click the mouse or press any key on the keyboard to wake it.**
- **Solution 2: Make sure the monitor is plugged in and turned on.**
- **Solution 3: Make sure the computer is plugged in and turned on.**
- **Solution 4: If you're using a desktop, make sure the monitor cable is properly connected to the computer tower and the monitor.**

6.6 Basic Maintenance concepts(Preventive, Corrective, online)

6.6.1 Computer maintenance is the practice of keeping computers in a good state of repair.

6.6.2 A computer containing accumulated dust and debris may not run properly.

6.6.3 Dust and debris will accumulate as a result of air cooling. Any filters used to mitigate this need regular service and changes. If the cooling system is not filtered then regular computer cleaning may prevent short circuits and overheating.

Preventive

The act of a regularly scheduled check of the computer hardware or software to help ensure it continues to operate properly. Below is a list of some preventive maintenance steps you can take with your computer or computer hardware.

Computer preventive maintenance

- Downloading the latest drivers for your hardware.
- Downloading the latest updates for your computer software.
- Verifying you have the latest antivirus protection updates on your computer.
- Running disk software utilities, such as Defrag and ScanDisk on your hard drive.
- Deleting unused programs or other files on your computer.
- Cleaning your computer hardware.

Corrective

Corrective maintenance, commonly referred to as 'repair,' is the correction of a problem after the computer has already broken down. The goal of this form of maintenance is to restore operability to the system by either correcting the problem or replacing the damaged components.

Online Maintenance

This includes modification and updates done in order to keep the software usable over long period of time. It includes new features,new user requirements for refining the software & improve its reliability and performance.

6.7 Diagnostic programs and tools

A diagnostic program (also known as a Test Mode) is an automatic computer program sequence that determines the operational status within the software, hardware, or any combination thereof in a component, a system, or a network of systems. Diagnostic programs ideally provide the user with guidance regarding any issues or problems found during its operation.

Five Best Computer Diagnostic Tools

6.7.1 #1 Windows Performance Monitor. The first one on our **list** is built right in to Windows operating systems. ...

6.7.2 #2 Windows Resource Monitor. Windows Resource Monitor is number two on our **list**. ...

6.7.3 #3 Open Hardware Monitor. ...

6.7.4 #4 Speccy. ...

6.7.5 #5 HD Tune.

6.8 Methods of Troubleshooting(symptom observation, analysis, diagnosis, Correction)

Troubleshooting is a form of problem solving, often applied to repair failed products or processes on a machine or a system. It is a logical, systematic search for the source of a problem in order to solve it, and make the product or process operational again.

Troubleshooting approach can be divided into following steps

- **Symptom observation**
- **Symptom analysis**
- **Fault diagnosis**
- **Fault rectification.**

Symptom Observation:

One should be very careful in observing the fault symptoms while troubleshooting. It is common that while troubleshooting the system, one will notice one or two symptoms and ignores remaining symptoms. But in case of multiple faults it will be impossible to

locate the exact fault or it will take more time and thus the downtime will be increased. So for efficient troubleshooting one should systematically approach a problem and starts troubleshooting with patience and careful observation of the symptoms. The time spent on symptoms observation in turn will yield proportional return during fault location.

Symptom Analysis:

The most important step in troubleshooting is the systematic analysis of the symptoms. A careful analysis of the symptoms will give a clue to the fault location process. When there are multiple symptoms one should try to correlate the various symptoms to identify the problems. If any relationship or clue is found, several steps can be skipped during fault location, thereby reducing the down time considerably.

Fault Diagnosis:

Fault diagnosis is a highly sophisticated scientific process. It needs intelligence, presence of mind and detective skill on the part of the engineer. The most important point here is the multidimensional view to be applied by the hardware engineer while troubleshooting problems.

Fault rectification

Finally the identified fault is rectified.

6.9 Up gradation of system and application software

Upgrading is the process of replacing a product with a newer version of the same product. In computing and consumer electronics an upgrade is generally a replacement of hardware, software or firmware with a newer or better version, in order to bring the system up to date or to improve its characteristics.

6.9.1 Examples of common hardware upgrades include installing additional memory (RAM), adding larger hard disks, replacing microprocessor cards or graphics cards, and installing new versions of software. Many other upgrades are possible as well.

6.9.2 Common software upgrades include changing the version of an operating system, of an office suite, of an anti-virus program, or of various other application sotware tools.

6.10 Virus concepts

6.10.1 A computer virus is a type of computer program that, when executed, replicates itself by modifying other computer programs and inserting its own code. If this replication succeeds, the affected areas are then said to be "infected" with a computer virus.

6.10.2 Computer viruses cause billions of dollars' worth of economic damage each year.

Antivirus

6.10.3 Antivirus software, originally designed to detect and remove viruses from computers, can also protect against a wide variety of threats, including other types of malicious software, such as keyloggers, browser hijackers, Trojan horses, worms, rootkits, spyware, adware, botnets and ransomware.

Best antivirus softwares of 2021

- **Bitdefender Antivirus Plus. Well rounded everyday antivirus protection. ...**
- **Norton AntiVirus Plus. Smooth protection for your system. ...**
- **Avira Antivirus Pro. ...**
- **F-Secure Antivirus SAFE. ...**
- **Kaspersky Anti-Virus. ...**
- **Trend Micro Antivirus+ Security. ...**
- **Webroot SecureAnywhere AntiVirus. ...**
- **ESET NOD32 Antivirus.**
- **Quickheal**

Short Question

1. Write different types of CPU?

Ans:- CPU types- Intel Core laptops are available in different variants – Dual core, core2 duo, quad core, i3, i5, i7 and i9.

2. Define Antivirus

Ans:- Antivirus software, originally designed to detect and remove viruses from computers, can also protect against a wide variety of threats, including other types of malicious software, such as keyloggers, browser hijackers, Trojan horses, worms, rootkits, spyware, adware, botnets and ransomware.

3. What is Troubleshooting?

Ans:-Troubleshooting is a form of problem solving, often applied to repair failed products or processes on a machine or a system. It is a logical, systematic search for the source of a problem in order to solve it, and make the product or process operational again

Long Question

1. What is trouble shooting? Describe the method of trouble shooting.[2020(w)]

2. Explain basic correction concept preventive ,corrective and online solution.

CHAPTER-07
NETWORKING DEVICES AND THEIR INTERFACES

7.1 Network Interface card
7.2 Networking interconnecting devices such as hub, switch, Router
7.3 Types of Network cable
7.4 Types of Network connector

7.1 Network Interface card

- A network interface card is used to connect a computer to an Ethernet network.
- The card provides an interface to the media.
- This may be either using an external transceiver mounted on the network interface card PCB.
- The card usually also contains the protocol firmware and Ethernet Controller needed to support the Medium Access Control (MAC) data link protocol used by Ethernet.

7.2 Networking interconnecting devices such as hub, switch, Router

- Computer network consists of different devices such as router, hub, switch and others.
- Without these network devices data cannot be transmitted from one computer to another in a LAN or WAN network.
- These devices link up all the local and remote network segments with each other to make data communication from one segment to another.
- The two important devices of a big network are routers and switches.

Hub

- A hub is a networking device, which is used to connect the two segments of a wired network.
- In star topology, every computer is directly connected with the hub. In case of any fault in the hub, the data communication in the network computers stops.
- In an Ethernet (bus)-based networked hub is a central device that is used to connect all the computers with each other.

switch

- A network switch performs the same functionality in a network as a hub expect a different that switch does not broadcast the data packets o all the computers in a network like a hub.
- A network switch has multiple ports like 4, 8, 16 and 24 etc.
- All the computers in a wired network are directly connected with the switch through Ethernet cable.
- Switches limit the traffic to and from each port and all the devices connected to the switch has maximum available bandwidth.

- Switch doesn't provide the built-in firewall capabilities like the routers. In the telecommunication and packet switched infrastructure switches play an important role.
- They transmit the data towards its destination based on the IP address.
- Switches work at data link layer.

Router

- A router is a network communication device that is used to connect two or more logically and physically different networks.
- A router can be used to connect a LAN to LAN, LAN to WAN and LAN to the internet.
- A router acts as a post office where sorting and distribution of the posts (packets in case of routers) is done.
- A router works on the basis of an IP address.
- Every router has a built-in Operating System known as IOS.
- A router works on the network layer of the OSI model and it routes the data towards the optimal path.
- Router uses the header information of the packets and forwarding table to define the best shortest possible path of the data.

7.3 Types of Network cable

- The transmission media is the physical path between the transmitter and receiver. Transmission media can be classified as guided and unguided.
- In both cases, communication is in the form of electromagnetic waves.
- With guided media, the waves are guided along a solid medium, such as copper twisted pair, copper coaxial cable and optical fiber.

  Guided media Examples-

  Twisted pair cable
  Coaxial cable Optic
  fiber cable
- The atmosphere is an example of unguided media that provide a means of transmitting electromagnetic signals but do not guide them, this form of transmission is usually referred to as wireless transmission.

Unguided media examples

Radio frequency Terrestrial
microwave Satellite
communication Cellular
telephony

As listed above, number of transmission media are available, selection of the media depends on the following factors

- Transmission rate
- Distances
- Cost and ease of installation
- Resistance to environmental conditions.

Twisted pair Cable:

Twisted pair is least expensive and most widely used. A twisted pair consists of two insulated copper wires arranged in a regular spiral pattern. A wire
pair acts as a single communication link. Twisting of copper wire is to reduce
cross talk.

Twisted pair comes in two varities:

- Unshielded twisted pair(UTP)
- Shielded twisted pair(STP)

UTP:

UTP is a set of twisted pairs of cable with in a plastic case. UTP is ordinary telephone wire. This is the cheapest transmission media. It is commonly used for LAN, its easy to work and install. UTP is subject to external electromagnetic interface. Category 3 and category 5 UTP are commonly used in computer networks. The differences between cat3 and cat5 cable is the number of twists in the cable per unit distance.

Shielded Twisted Pair (STP):

STP offers a protective sheathing around the copper wire. STP provides better performance at lower data rates. They are not commonly used in networks. Installation is easy. Special connectors are required for installation. Cost slight higher than UTP. STP will still suffer from outside interference but not as much as UTP.

Applications of Twisted Pair:

- Twisted pair cable used for both analog and digital signals.
- Twisted pair used in telephone network.
- In LAN, twisted pair wires mainly use for low cost, low performance applications.

Coaxial cables:

- It is made up of two conductors that share the common axis.
- It consists of a hollow outer cylindrical conductor that surrounds a single inner wire conductor.
- Coaxial cable is used to transmit both analog and digital signals.
- Data transfer rate of coaxial cable is n between twisted pair and optic fiber cable.
- It is relatively inexpensive. Installation is relatively simple. Following figure shows a coaxial cable.

Applications of coaxial cable:

- Coaxial cable used for both transmissions. i.e., analog and digital data transmission.
- It is used in thick Ethernet as well as thin Ethernet.
- It is used for cable TV.

Optic Fiber Cable:

In optic fiber technology, light is used to transmit signals instead of electronics. At a fixed rate, the presence of the light means 1, the absence 0, for example.

Three components are required for optic fiber.

Light Source: typically, a light emitting diode, or a laser diode.

Addressing

Fiber Medium: Current technology carries light pulses for tremendous distance with virtually no signal loss.

Detector: which detects the light and converts it into electric signals.

Applications of Fiber Optics:

- ➢ Long haul trunks – backbone network, telephone network.
- ➢ Metropolitan trunks - without repeaters.
- ➢ Rural exchange trunks – link town and villages.
- ➢ Local loops – direct from central exchange to subscriber.
- ➢ Local area network -100 Mbps ring networks.

Comparison of performance characteristics of guided media:

Coaxial	Twisted pair	Optic fiber
It uses an electric signal for transmission.	Uses electric signal for transmission	Focuses optical form over a glass fiber.
Less affect by EMI (Electromagnetic Interference)	Affected by EMI	Not affected by EMI
Bandwidth is moderately high	Bandwidth is low	Bandwidth is very high
Supports moderately high data rates	Supports low data rates	Data rate is very high
Moderately costly	Cheapest	costly
Repeater spacing is 1-10 km	Repeater spacing 2-10 km	Repeater spacing 10-100 km

Comparison of advantages and disadvantages of guided media:

Media	Advantages	Disadvantages
Twisted pair cable	v Inexpensive v Easy installation & use v Easy to add notes	v Sensitive to noise v Short distances v Limited bandwidth v No security signal can be easily tapped.
Coaxial cable	v High bandwidth v Long distance v Noise immunity	v Physical dimensions v No security signal can be easily tapped
Optic fiber cable	v Very high bandwidth v Noise immunity v Long distance v High security v Small size	v Special equipment is needed for installation v Adding a node is difficult v Very expensive

7.4 Types of Network connector

connectors act as an interference between NIC of the computer and the cable that transmits the signal.

Coaxial cable connector:

To connect a coaxial cable to an NIC, the following connectors are required.

- BNC connector
- T connector
- Terminator
- BNC barrel connector

· **The BNC Connector:** The BNC cable connector is either soldered or crimped to the end of a cable.

· **The BNC connector:** This joins the network interface card in the computer to the network cable.

· **The BNC Barrel Connector:** This is used to join two lengths of cable to make one longer lenth.

· **The BNC terminator:** This closes each end of the bus cable to absorb stray signals. Without BNC terminators, a bus network will not function.

Twisted Pair Connectors: UTP and STP use different connectors to connect with the NIC. A STP cable connects to an NIC with an RJ 45 connector, whereas an STP cable uses a DB-9 connector.

Optical Fiber Connector:

All fiber-optic connectors use ferrules to hold the ends of the fiber and keep them properly aligned.

The SC uses a push-pull connector similar to common audio and video plugs and sockets.

The MIC is the standard FDDI connector.

The fiber jack connector attaches two fibers in a snap lock connector similar in size and ease of use as an RJ-45 connector.

MT-RJ is a popular connector for two fibers in a very small form factor.

Short Question

1.What is Network Interface card(NIC)?

Ans:- A network interface card is used to connect a computer to an Ethernet network.

- The card provides an interface to the media.
- This may be either using an external transceiver mounted on the network interface card PCB.

2. Define Coaxial cables.

Ans:- ● It is made up of two conductors that share the common axis.

● It consists of a hollow outer cylindrical conductor that surrounds a single inner wire conductor.

● Coaxial cable is used to transmit both analog and digital signals.

● Data transfer rate of coaxial cable is n between twisted pair and optic fiber cable**.**

3. Define UTP.

Ans:- UTP is a set of twisted pairs of cable with in a plastic case. UTP is ordinary telephone wire. This is the cheapest transmission media. It is commonly used for LAN, its easy to work and install. UTP is subject to external electromagnetic interface**.**

4. Define Shielded Twisted Pair (STP):

Ans:- STP offers a protective sheathing around the copper wire. STP provides better performance at lower data rates. They are not commonly used in networks. Installation is easy**.**

Long Question

1. Explain the Network interconnecting devices such as Hub, Switch and Router.[2020(w)

2. Explain the different Network cable used in computer network.

3. Explain the types of network connector how optical Fiber connector