CHANDIGARH UNIVERSITY

LAB MANUAL

WORKSHOP TECHNOLOGY

22CSP-102

BATCH: 2022-2026

NAME:

UID:

BRANCH & SECTION:

Workshop Technology (22CSP102)

Section: A (List of Practical's Computer Domain)

Elementary Knowledge of Computers

Practical 1.1: Elementary and fundamental parts of Computer Hardware.
Demonstration of All Components of CPU- Motherboard, SMPS, Processor, Memory, Ports (Serial, Parallel,Universal).

Practical 1.2: Assembly/ Reassembly/ Booting Process & Installation.
Building a CPU from all the attached parts, booting process & installing windows on the system.

Practical 1.3: Memories
Concepts of Memory Hierarchy, Difference in terms of speed, capacity, storage type & volatility. Demonstration of various types of memories installed in the system.

Practical 2.1: Network Components
Networks- Basics, file/device sharing & preparing a straight and crossover network cable using a clamping tool.

Practical 2.2: Various troubleshooting & Demonstrations
Various troubleshooting's like

a. System not starting
b. Printer not printing
c. Not able to share files on network.
d. I/O devices not working.

Section: B (List of Practical's Mechanical Domain)

Practical 2.3: Fitting Shop
To make a job to controlled dimensions, involving different operations like, marking, measuring, punching, hack sawing, filing, drilling and tapping & Radiusing etc.

Practical 2.4: Sheet Metal Shop
(a) To make different sheet metal joints from Galvanized Iron (GI) sheet in sheet metal shop. (b) To make a Rectangular Tray from galvanized iron (GI) sheet in sheet metal shop.

Practical 3.1: Electrical & Electronics Shop
To make a house wiring circuit as per given diagram using different electrical accessories and energy meter etc.

Practical 3.2: Electrical & Electronics Shop
To make a full wave Centre tapped rectifier by soldering using different electrical and electronic components.

Practical 3.3: Machine Shop
To make a multi operation job on Centre Lathe machine from MS round bar, involving operations- Facing, Plain Turning, Step Turning, Taper Turning (using compound slide method), Chamfering & Knurling etc.

Section: A (Practical's from Computer Domain)

Practical 1.1: Elementary and fundamental parts of Computer Hardware.

Objective: To draw a sketch of motherboard, showcasing the PCI slots, Memory slots, Processor, CPU Fan, Heat Sink, Capacitors, Inductors and fan connector and explain the importance and requirement of these devices.

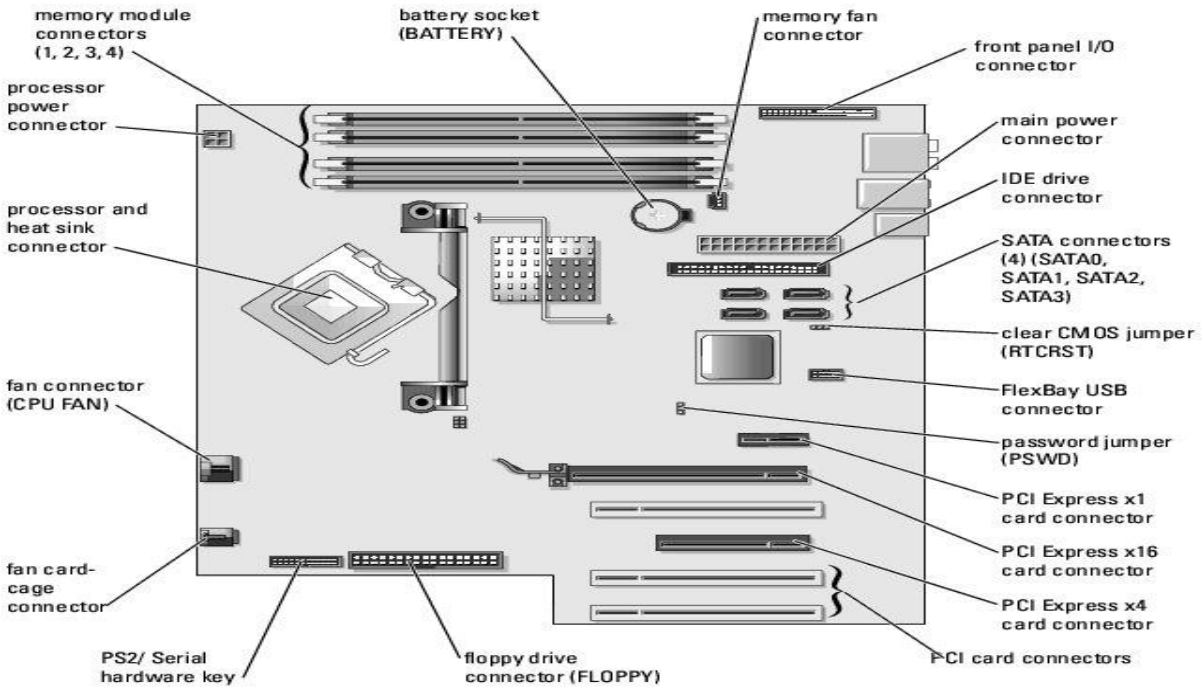


Image Source:http://1.bp.blogspot.com/_Go1SJC7y0SI/SQkhzaUUXZI/AAAAAAAAAX4/QuLQyQ2OZ7s/s1600-h/motherbrd1.jpg

1. Motherboard:

Let us begin with the main role of a motherboard. In essence, it serves two purposes:

- Provide electrical power to the individual components
- Provide a route to allow the components to communicate with each other

There are other things a motherboard does (e.g. holds the components in place, or provides feedback as to how well everything is functioning) but the aforementioned aspects are critical to how a PC operates, that almost every other part that makes up the motherboard, is related to these two things.

- Nearly every motherboard used in a standard desktop PC today will have sockets for the central processing unit (CPU), memory modules (nearly always a type of DRAM), add-in expansion cards (such a graphics card), storage, input/outputs, and a means to communicate with other computers and systems.
- Standard motherboards initially differ in terms of their size, and there are industry-wide standards that manufacturers tend to adhere to (and plenty of others that don't)
- According to Wikipedia, a motherboard (also called mainboard, main circuit board, system board, baseboard, planar board, logic board, or mobo) 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.

- Unlike a backplane, a motherboard usually contains significant sub-systems, such as the central processor, the chipset's input/output and memory controllers, interface connectors, and other components integrated for general use.

- This board is often referred to as the "mother" of all components attached to it, which often include peripherals, interface cards, and daughter cards: sound cards, video cards, network cards, host bus adapters, TV tuner cards, IEEE 1394 cards; and a variety of other custom components.

2. Expansion Slots:

- Alternatively referred to as a bus **slot** or **expansion** port, an **expansion slot** is connection or port located inside a computer on the motherboard or riser board that allows a computer hardware **expansion** card to be connected to add functionality to a computer system via the expansion bus.

2 (a). Why do computers have expansion slots?

- Computers have expansion slots to give the user the ability to add new devices to their computer.

- For example, a computer gamer may upgrade their video card to get better performance in their games.

- An expansion slot allows them to remove the old video card and add a new video card without replacing the motherboard.

3. PCI Slots:

- Short for **peripheral component interconnect**, **PCI** was introduced by Intel in 1992.
- The PCI bus came in both 32-bit (133 MBps) and 64-bit versions and was used to attach hardware to a computer.
- Although commonly used in computers from the late 1990s to the early 2000s, PCI has since been replaced with PCI Express.
- PCI has begun to die out quite a bit though, and has been succeeded by PCI Express.
- There is a very big difference between the two.
- PCI was a parallel interface, which means that it dealt with large amounts of data by splitting them up and sending them at a low speed.
- PCI Express, in contrast, is a serial interface, which means that it sends them one at a time, really fast. Imagine that you have 20 people who all have to cross a river.
- In a parallel interface, 10 of the people will cross at once. Each one has a very specific landing point.
- However, when they are crossing, inevitably some will get mixed up in their landing spot, and will have to cross again.

4. Heat Sink:

- A heat sink is a device that incorporates a fan or another mechanism to reduce the temperature of a hardware component (e.g., processor).
- There are two heat sink types: active and passive. The picture is an example of a heat sink that has both active and passive cooling mechanisms.

4(a). Active Heat Sink

- Active heat sinks utilize the computer's power supply and may include a fan.
- Sometimes these types of heat sinks are referred to as an HSF, which is short for heat sink and fan.
- There are also liquid cooling systems, which have become popular in recent years.
- **Active heat sinks** are often used in conjunction with passive **heat sinks**.

4(b). Passive heat sink

- Passive heat sinks are those that have no mechanical components. Consequently, they are 100% reliable.
- Passive heat sinks are made of an aluminium finned radiator that dissipates heat through convection.
- For passive heat sinks to work to their full capacity, there should be a steady airflow moving across the fins.

5. Capacitor

- In layman's terms, a capacitor is a tiny electrical component soldered to the motherboard. Capacitors perform a couple of different functions.
- First, a capacitor conditions DC voltage to other components (e.g. the video card, hard drive, sound card etc) as a way to provide a steady stream of power.
- Finally, a capacitor can also hold or store an electric charge to be discharged at a later time, such as in the case of a camera flash.
- So, that's what capacitors are, but what do they do? As we already mentioned, one of the functions of a capacitor is that it conditions power to be sent to other components.
- The reason for this is that, while components rely on electricity to run, they're also very sensitive to swings in voltage.
- For instance, a voltage surge or spike could completely fry all of the components within your PC.
- After spending a good amount of money on hardware, that's not something you really want.
- Unfortunately, voltage amounts change all the time — they aren't constant. So, how do you stop it from frying your components? With a capacitor.

6. Inductors

- Short for electromagnetic coil, a coil is conducting wire such as copper shaped in a helical form around an iron core.
- The coil creates an inductor or electromagnet to store magnetic energy. Coils are often used to remove power spikes and dips from power.
- The picture is an example of an inductor on a computer motherboard.
- An inductor is essentially a coil of wire. When current flows through an inductor, a magnetic field is created, and the inductor will store this magnetic energy until it is released.
- In some ways, an inductor is the opposite of a capacitor.
- While a capacitor stores voltage as electrical energy, an inductor stores current as magnetic energy.
- Thus, a capacitor opposes a change in the voltage of a circuit, while an inductor opposes a change in its current.

7. CPU

- Central processing unit is to computer what brain is to our body. It is the master organ of a computer.
- No computer can exist without a CPU.
- It is composed of two simpler hardware units - Arithmetic Logic Unit (ALU) and Control Unit (CU).
- CU controls all the activities of other hardware units while ALU performs all the calculations.
- Computer CPUs are very fast in their calculations and swift in control.
- The architecture of CPU was given by Von Neumann and most modern CPU's are primarily Von Neumann in architecture.
- Then with the advent of the Transistor, transistorized CPU's were built.

- Earlier CPU's were built out of bulky, unreliable and fragile switching elements like vacuum tubes and relays.
- **Control Unit:** It tells the computer's memory, arithmetic logic unit and input and output devices how to respond to the instructions that have been sent to the processor. It provides timings and control signals.
- **ALU:** It is responsible for arithmetic (add, subtract, 2's complement, decrement, increment operations), logical(and,or,ex-or,1's complement) and bit shift operations.
- **Registers:** Memory Address Register, Memory Data Register, Program Counter and Accumulator.
- **Memory:** The storage component of the CPU.

Video Link: Motherboard
https://www.youtube.com/watch?v=b2pd3Y6aBag&t=187s

Practical 1.2: Assembly/ Reassembly/ Booting Process & Installation.

Objective: Write down the steps to install a window on a newly assembled personal computer. Include the Scanned Images of all the steps in the worksheet.
Material Required: Plain A-4 size Sheet, Pen.
Steps to install Windows:

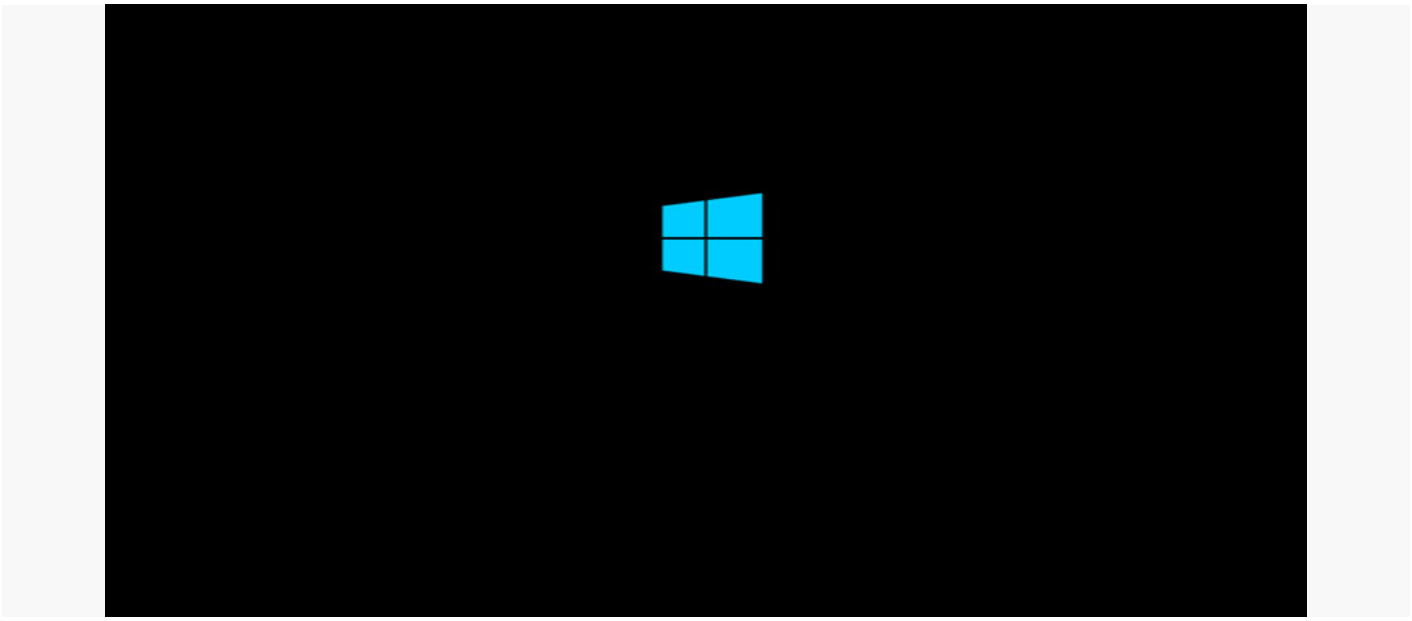
You can perform a clean installation of Windows 8.1 if you purchased Windows 8.1 on DVD or purchased a download of Windows 8.1. A clean installation typically means formatting your hard drive before installing Windows, so make sure that you have backed up your files and created recovery disc by MSI Burn Recovery tool before proceeding.

To perform a clean installation using a DVD or USB flash drive

If you bought Windows 8.1 on DVD or created a DVD or USB flash drive when you purchased and downloaded Windows 8.1, follow these steps to perform a clean installation.

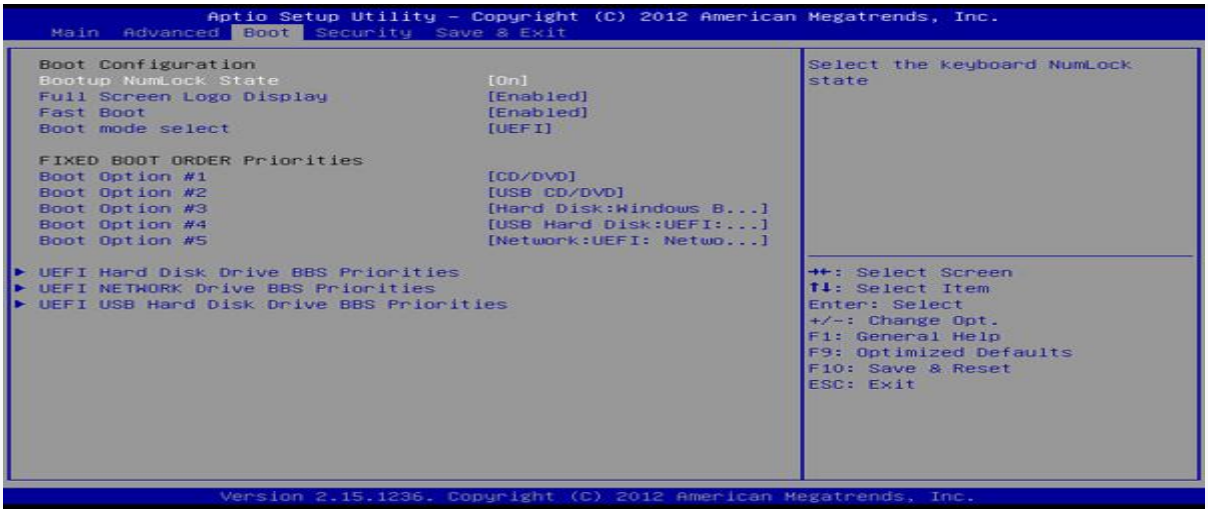
1. Turn on your PC so that Windows starts normally, insert the Windows 8.1 DVD or USB flash drive, and then shut down your PC.

2. Restart your PC. Your laptop will boot from Windows 8.1 DVD or USB flash drive. Press any key when prompted by message “Press any key to boot from CD or DVD…”.



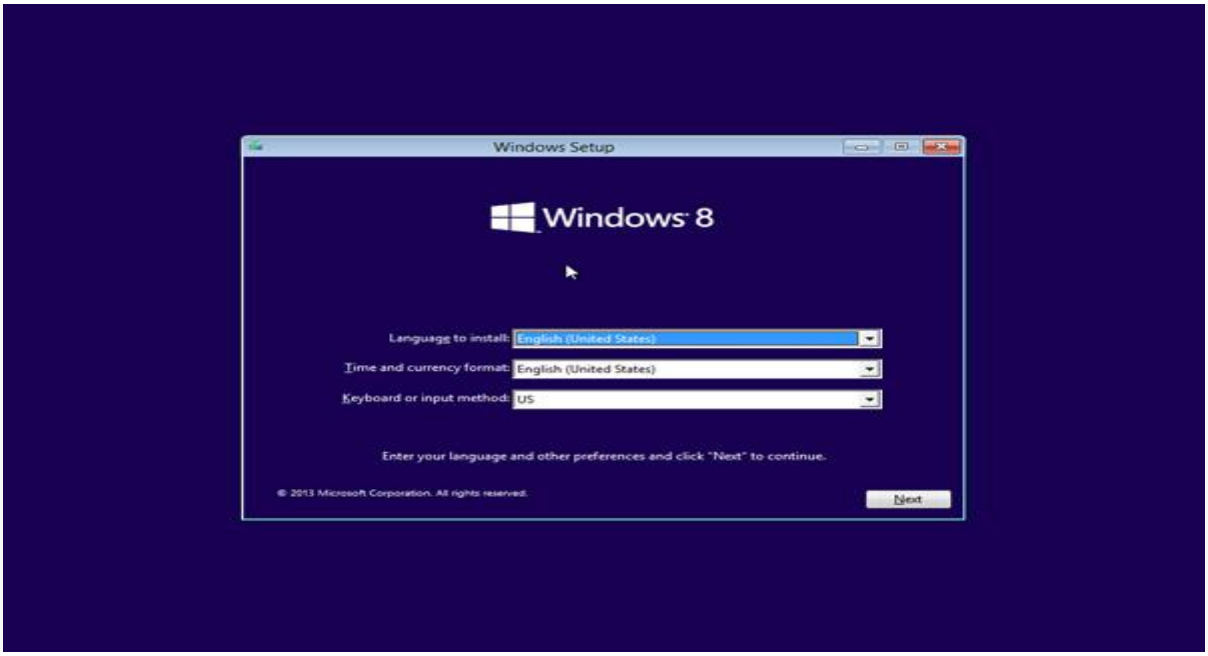
If you restart your PC and your current version of Windows starts, you might have to change the boot order in your PC's BIOS settings so that your PC boots from the media.

To change the boot order, you'll generally press Delete key immediately after you turn on your PC. When you get into BIOS Setup Menu, please select Boot tab and set your media as the first boot order.



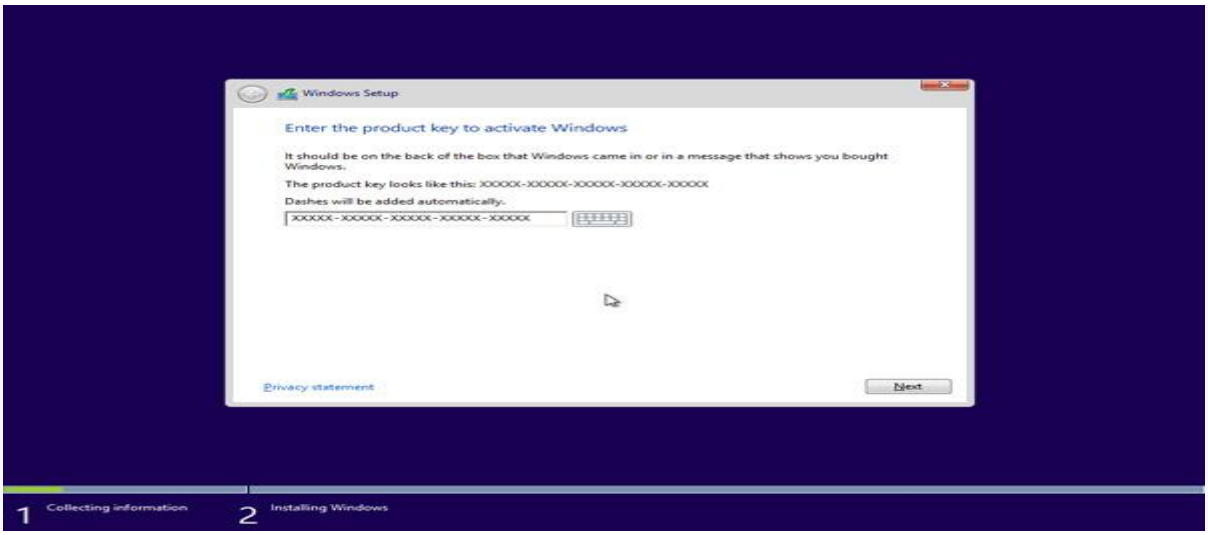
Move to Save & Exit tab, select [Save Changes and Reset] and leave BIOS Setup Menu.

3. Please setup language along with other preferences and click [Next].

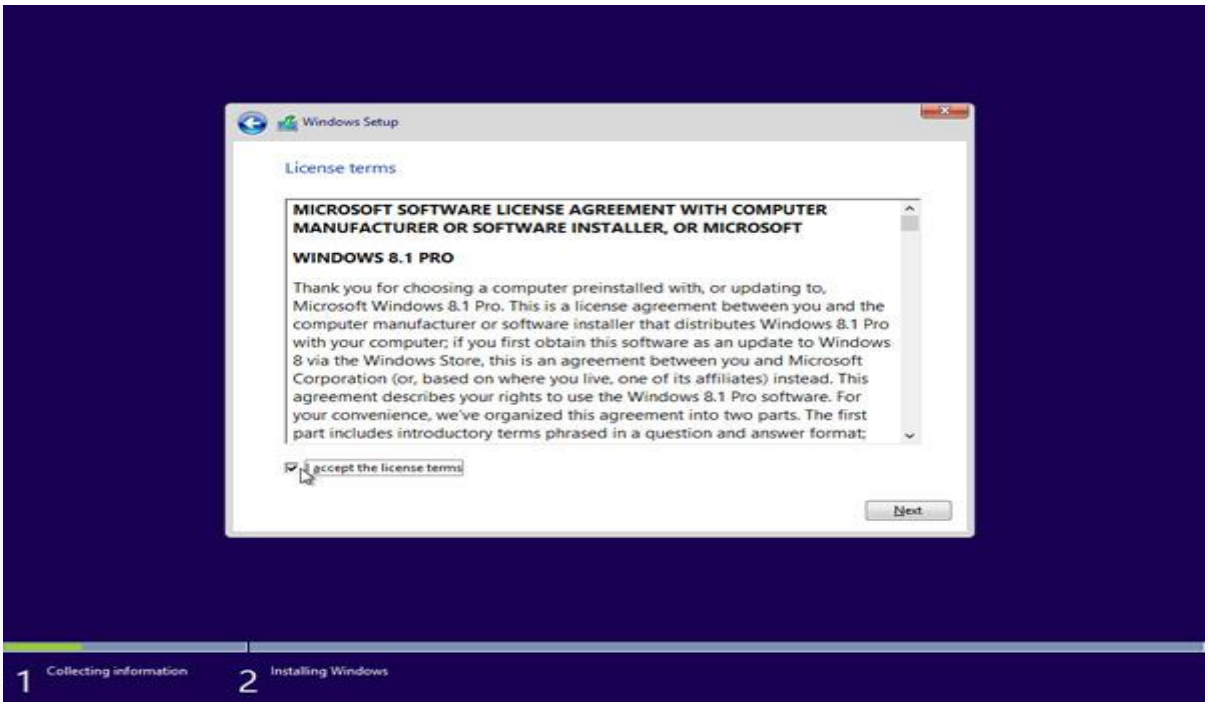


4. Click [Install now] to start the process.

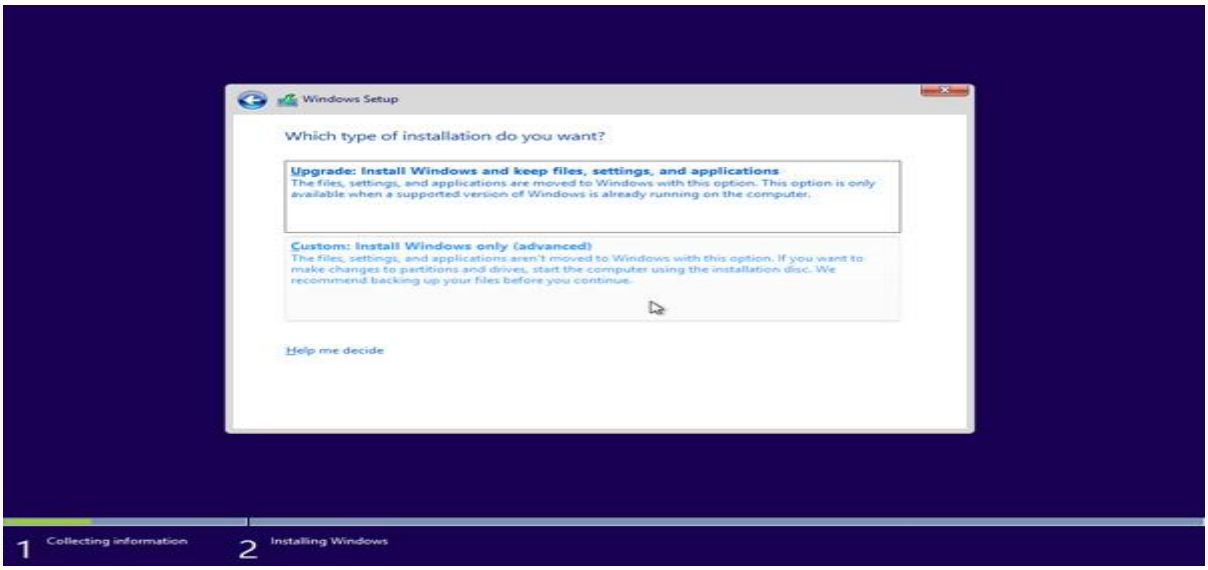
5. Enter the product key to activate Windows 8.1 and click [Next]. (You should find the key in the disc package or in a message that shows you bought Windows. If not, please contact disc provider.)



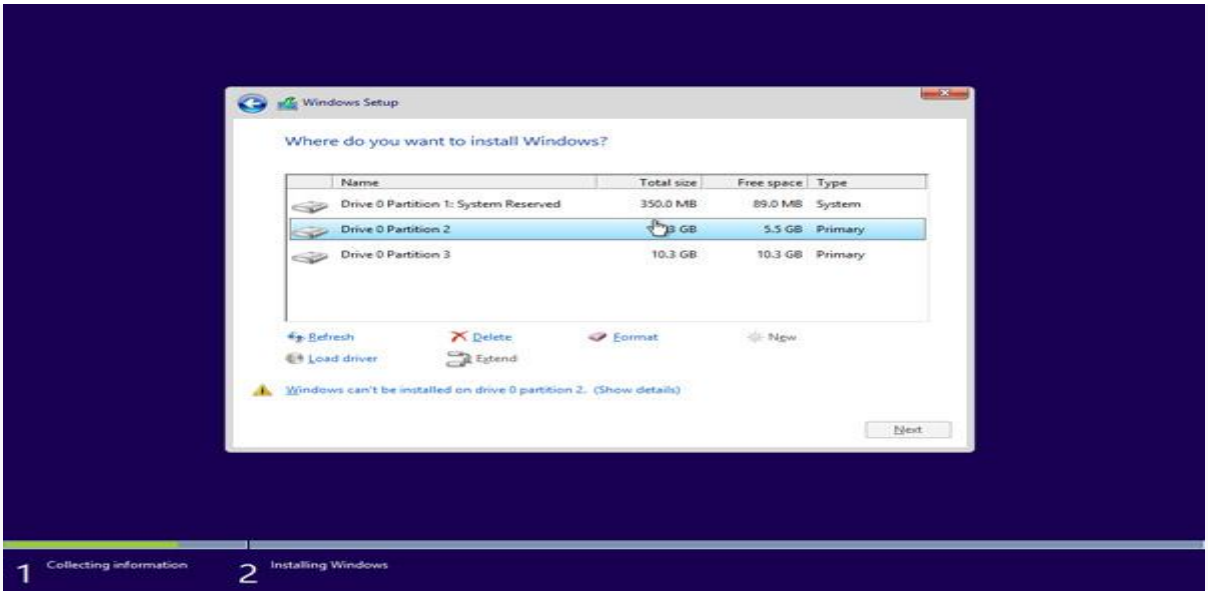
6. Accept the license terms and click [Next].



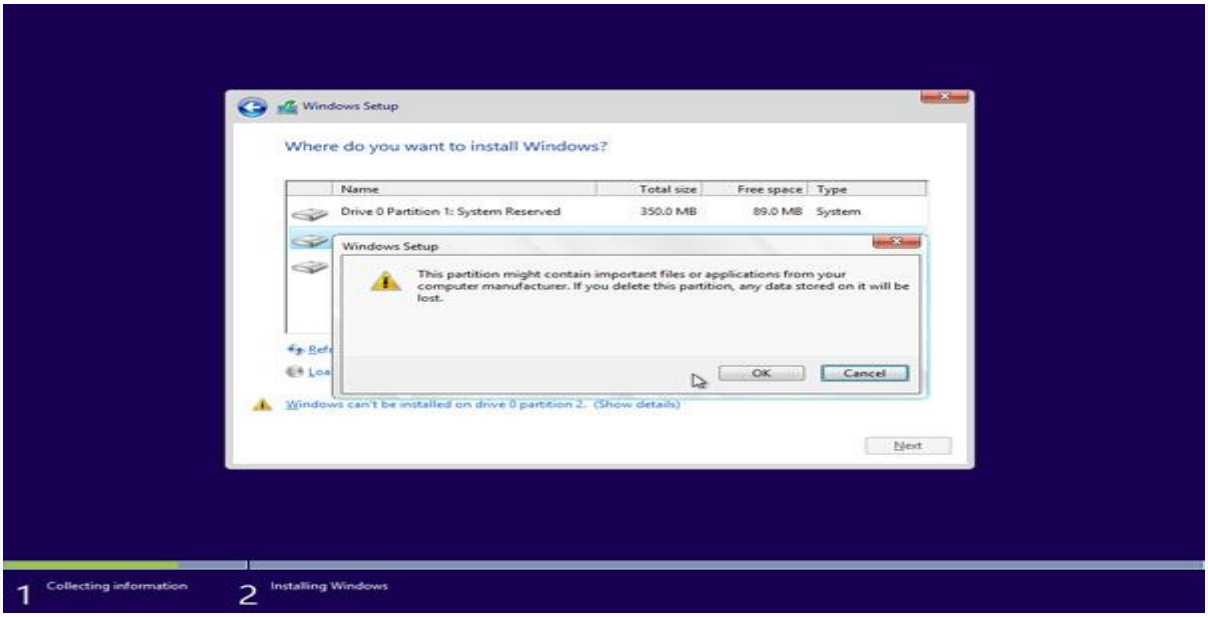
7. Choose the installation type you want. MSI recommend [Custom: Install Windows only (advanced)].



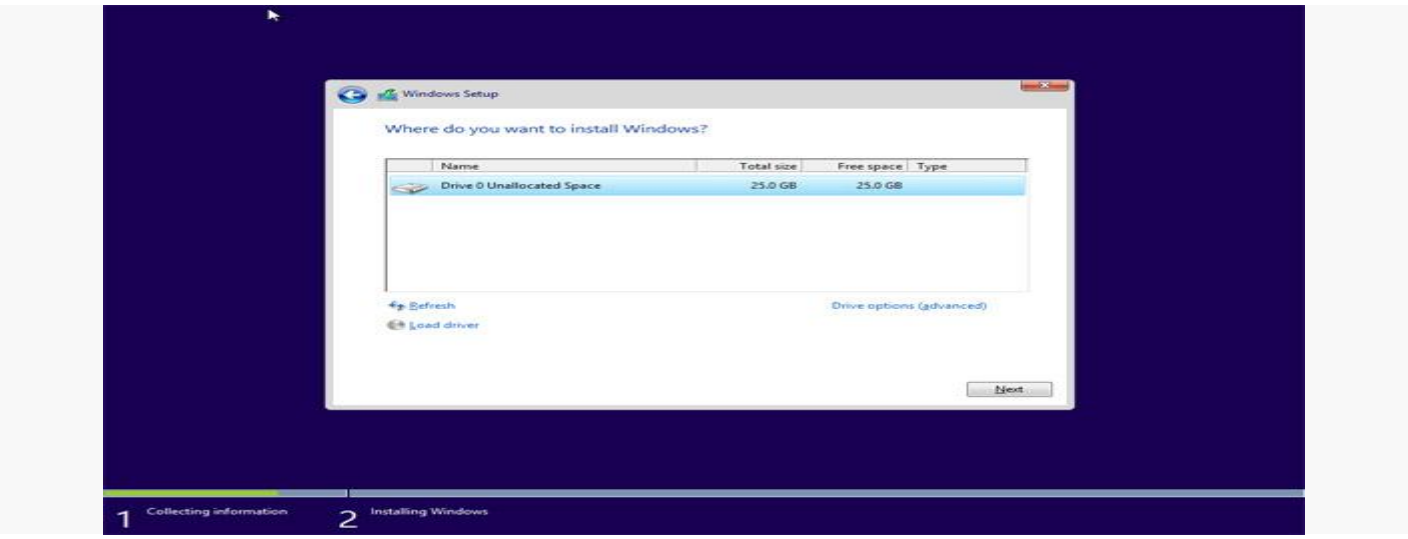
8. Delete all existing partitions by selecting one partition at a time and then click [Delete] link.



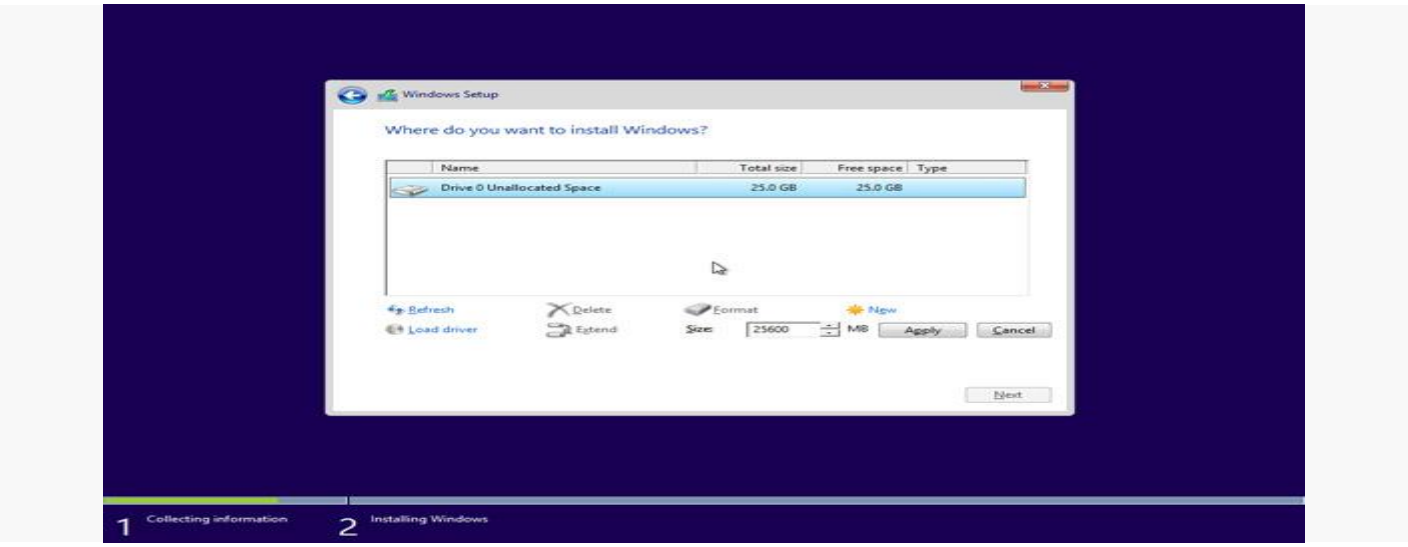
9. Press [OK] when prompted by the message.



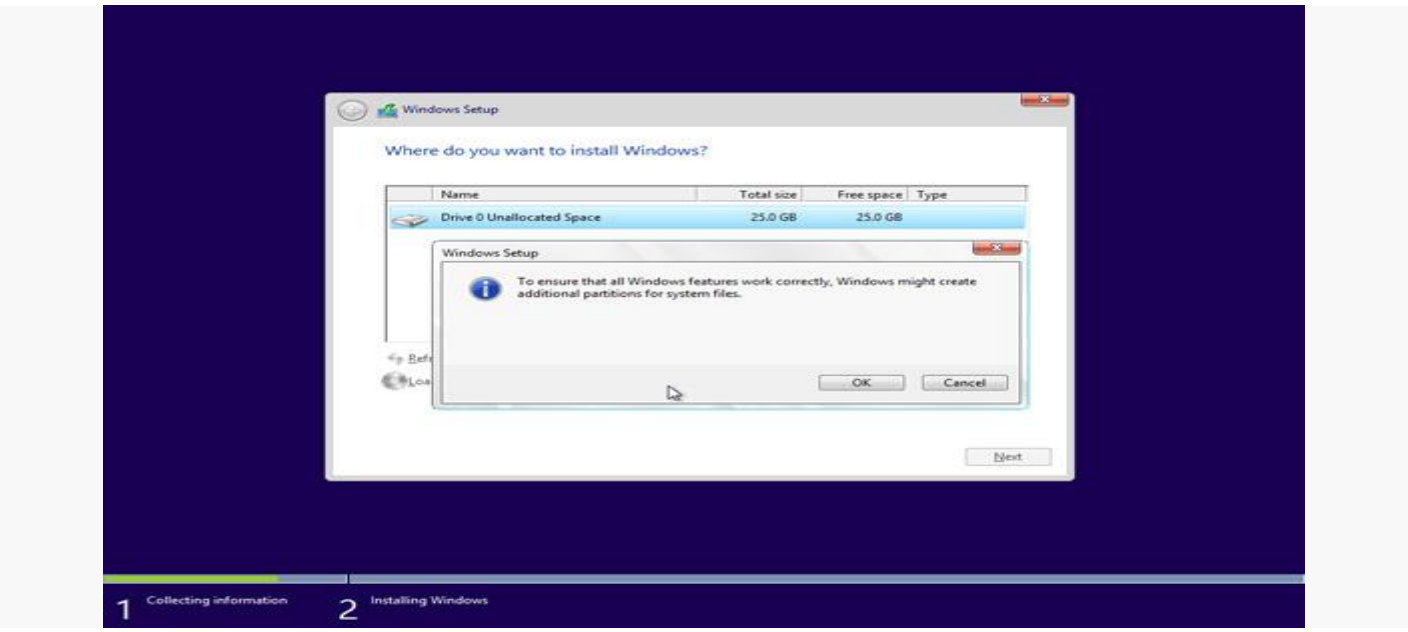
10. All the space on the hard drive is now unallocated. Please create partitions by clicking [Drive options (advanced)].



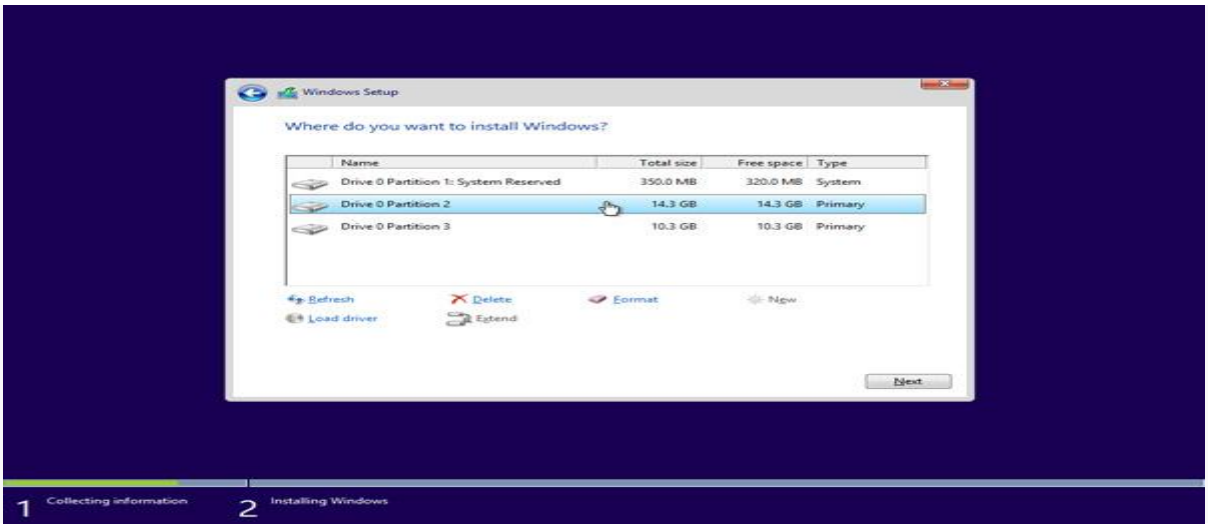
11. Click [New] and decide a proper partition size for the partition.



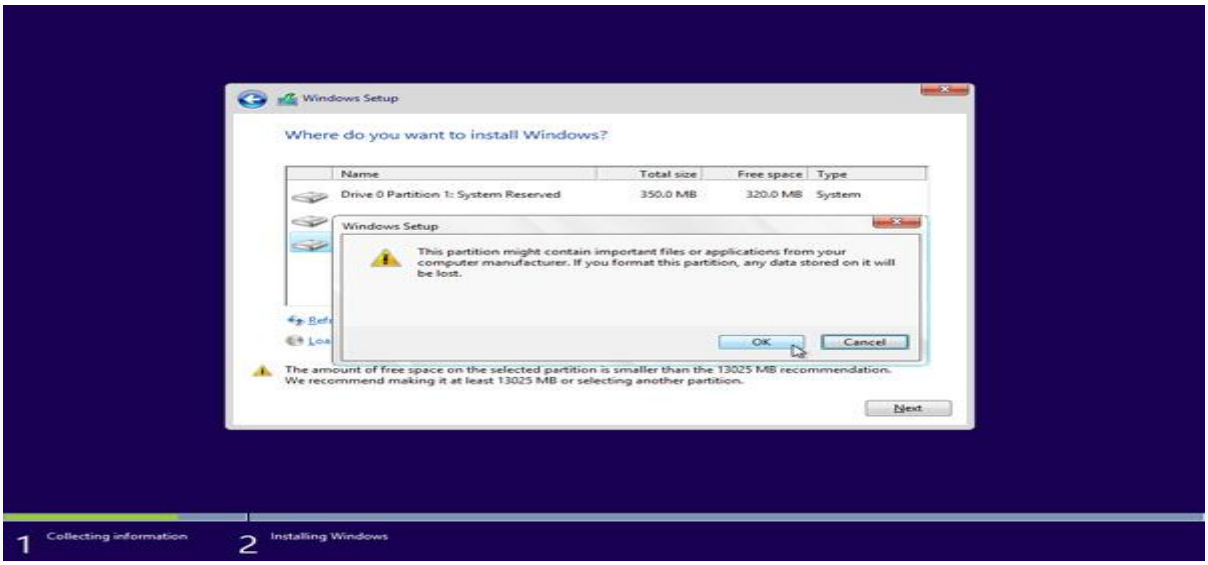
12. Windows will create another partition to store system files in. Please press [OK]. Follow step 10 to create partitions for the rest of unallocated space if required.



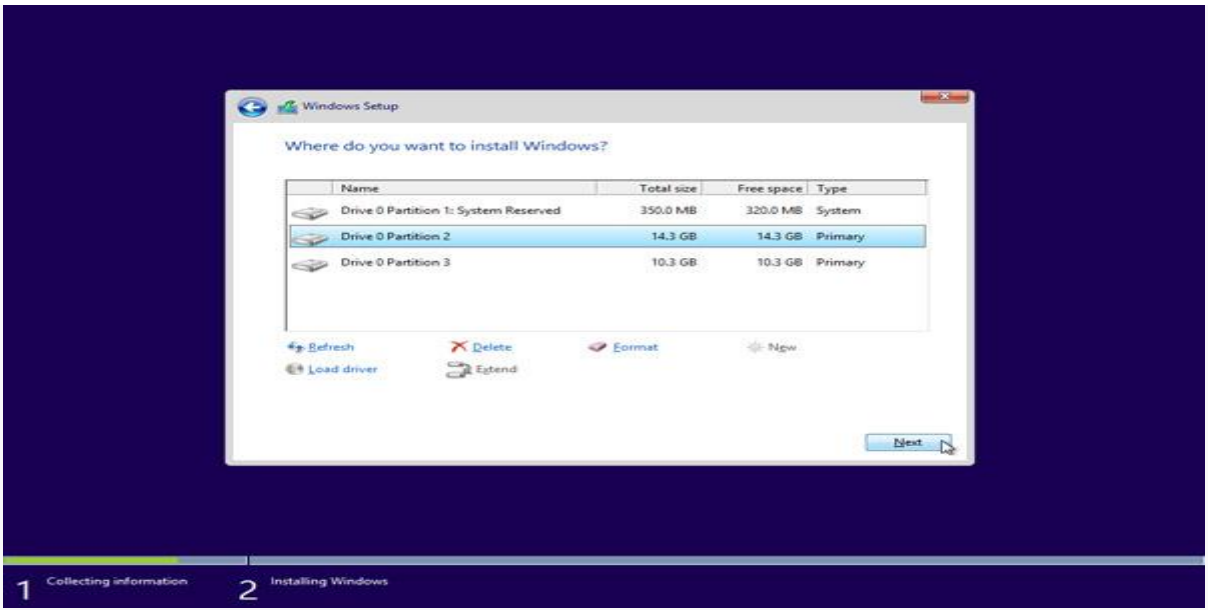
13. Select one partition and click [Format] link to perform partition format.



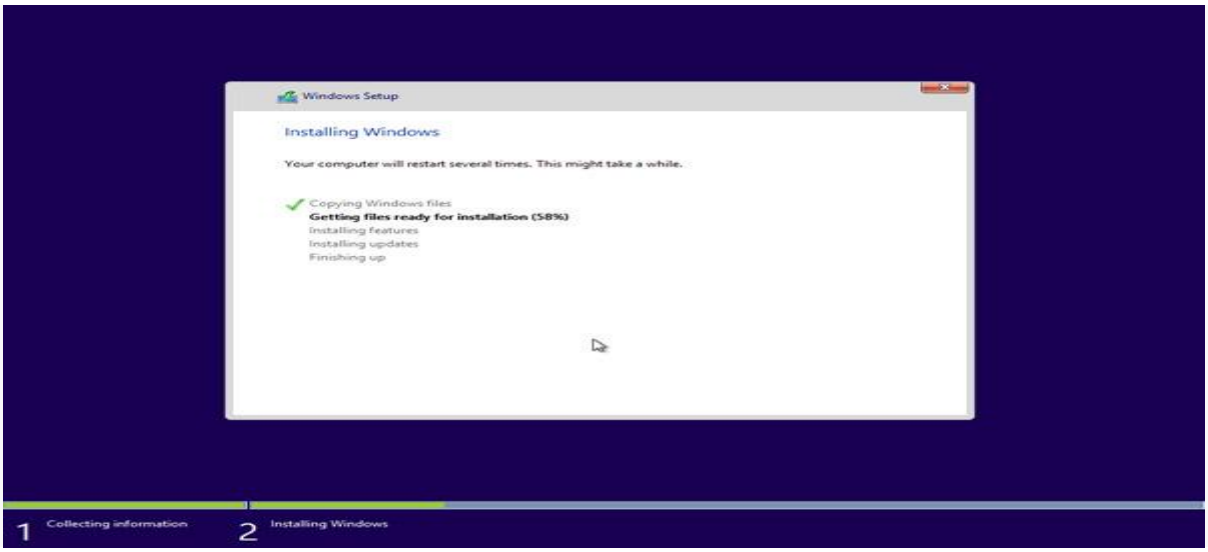
14. You will be prompted to confirm the process. Press [OK]. Format other partitions as well except the one reserved for system files.



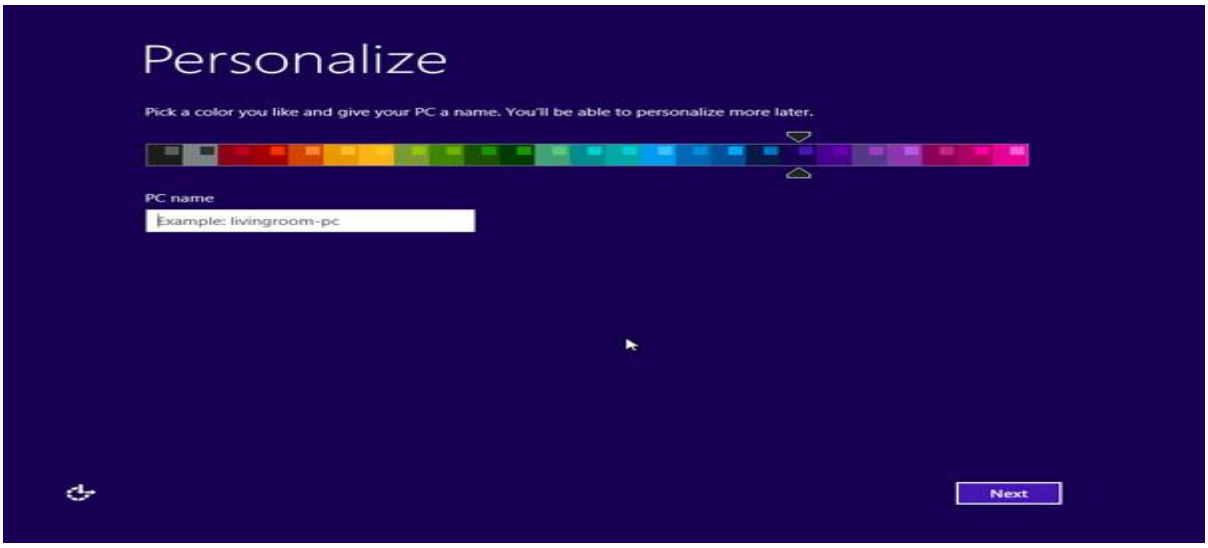
15. Select the partition where you want to install Windows to and press [Next].



16. Windows 8.1 is being installed and it will require several reboots during the process.



17. Please follow onscreen instructions to personalize computer settings.



18. Windows 8.1 is now installed successfully. Please perform Windows update and install the latest firmware/driver/app updates downloaded from MSI website.

Practical 1.2 (a)

Objective: Write down the steps to assemble/disassemble the Personal Computer.

Material Required: Plain A-4 size Sheet, Pen.

Disassembling:

Disassembling means parting the different components of a computer from the system unit. To perform disassembling, the tasks goes like unplugging, unscrewing and then lifting the adapters, drives & other components.

STEPS TO DISASSEMBLE A PC:

1. Unplug every cable:

Wear a grounding strap or touch an unpainted metal part of the computer to discharge any static electricity. If you walk across a carpet at any point, touch an unpainted metal part of the computer again to discharge the built up static electricity. The first thing we have to do, is unplug every cable that's plugged in to computer. That includes the following cables:

- Power
- USB
- Mouse
- Keyboard
- Internet
- Ethernet
- Modem
- AM\FM Antenna
- Cable TV, etc.

Figure 9.1 Unplugging

Image Source:https://content.instructables.com/ORIG/F52/KDQJ/JSCG6R9P/F52KDQJJSCG6R9P.jpg?auto=webp&frame=1&crop=3:2&width=595&fit=bounds&md=2556c3496ab847f9921ed57ab93af016

2. Remove the Cover:

The standard way of removing tower cases used to be to undo the screws on the back of the case, slide the cover back about an inch and lift it off. The screwdrivers as per the type of screw are required to do the task.

Figure 9.2 Remove Cabinet case

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3.Remove the adapter cards:

Make sure if the card has any cables or wires that might be attached and decide if it would be easier to remove them before or after you remove the card. Remove the screw, if any, which holds the card in place. Grab the card by its edges, front and back, and gently rock it lengthwise to release it.

4.Remove the power supply:

The power supply is attached into tower cabinet at the top back end of the tower. Make sure the power connector is detached from the switchboard. Start removing the power connector connected to motherboard including CPU fan power connector, cabinet fan, the front panel of cabinet power buttons and all the remaining drives if not detached yet. Now remove the screws of SMPS from the back of the cabinet and the SMPS can be detached from the tower cabinet.

Figure 9.3 Remove Power Supply

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The Power Supply is a large metal box located in the top left corner.

The power supply supplies power to every component in a computer; therefore, it has the most wires

out of every other component in the computer. The first thing you do is unplug every wire coming from the power supply. The list below is everything that you have to disconnect:

• Motherboard (very large connector/plug)

• CD/DVD drive[s] power

• Internal hard drive power

• Portable hard drive slot power

Once everything is unplugged, unscrew the screws holding the power supply in place, on the back of the computer. Next, push the power supply from the outside, then lift it out.

Keep the screws/bolt aside in a bag so when you assembling it back, it will be easier.

5.Remove the drives:

Removing drives is easier. There can be possibly three types of drives present in your computer system, Hard disk drive, CD/DVD/Blue-ray drives, floppy disk drives (almost absolute now a day). They usually have a power connector and a data cable attached from the device to a controller card or a connector on the motherboard. CD/DVD/Blue Ray drive may have an analog cable connected to the sound card for direct audio output. The power may be attached using one of two connectors, a Molex connector or a Berg connector for the drive. The Molex connector may require to be wiggled slightly from side to side and apply gentle pressure outwards. The Berg connector may just pull out or it may have a small tab which has to be lifted with a screwdriver.

Figure 9.4 Remove drives

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Now pull data cables off from the drive as well as motherboard connector. The hard disk drive and CD/DVD drives have two types of data cables. IDE and SATA cables. The IDE cables need better care while being removed as it may cause the damage to drive connector pins. Gently wiggle the cable sideways and remove it. The SATA cables can be removed easily by pressing the tab and pulling the connector straight back.

Now remove the screws and slide the drive out the back of the bay.

6.Remove the system FAN:

Most computers have two fans: the system fan, the one blowing air into the computer, and the CPU fan, the one blowing air onto the CPU heat sink.

The system fan is located at the back side of the computer, the side with all the component plugins. First, unplug the fan from the motherboard. You can find the plug by following the wire from the fan. It

should be labelled "SYS_FAN1". Next, you will have to unscrew the fan from the outside.

You should now be able to lift the fan out of the PC.

Keep the screws/bolt aside in a bag so when you assembling it back, it will be easier.

Figure 9.5 Remove System FAN

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7.Remove the memory module:

Memory modules are mounted on the motherboard as the chips that can be damaged by manual force if applied improperly. Be careful and handle the chip only by the edges. SIMMs and DIMMs are removed in a different way:

1. SIMM - gently push back the metal tabs while holding the SIMM chips in the socket. Tilt the SIMM chip away from the tabs until a 45% angle. It will now lift out of the socket. Put SIMM in a safe place.

2. DIMM- There are plastic tabs on the end of the DIMM sockets. Press the tabs down and away from the socket. The DIMM will lift slightly. Now grab it by the edges and place it safely. Do not let the chips get dust at all.

Figure 9.6 Remove RAM chips

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8.Remove the motherboard:

Before removing all the connectors from the motherboard, make sure u memorize the connectors for assembling the computer if required, as that may require connecting the connectors at its place.

Remove the screws from the back of the motherboard and you will be able to detach it from the cabinet. Now remove the CPU fan from the motherboard. The heat sink will be visible now which can be removed by the pulling the tab upward. Finally, the processor is visible now, which can be removed by the plastic tab which can be pulled back one stretching it side way.

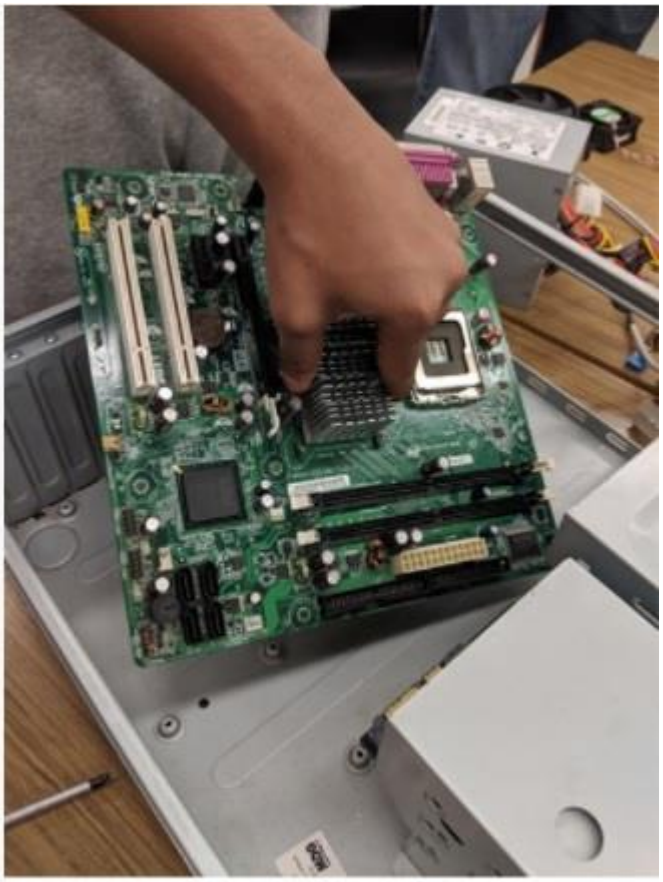

Figure 9.7 Remove Motherboard

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ASSEMBLING A PC

1. INSTALL POWER SUPPLY

Power supply installation steps include the following:

- Insert the power supply into the case
- Align the holes in the power supply with the holes in the case
- Secure the power supply to the case using the proper screws

2. ATTACH CPU ON MOTHERBOARD

- Align the CPU so that the Connection 1 indicator is lined up with Pin 1 on the CPU socket.
- Place the CPU gently into the socket.
- Close the CPU load plate and secure it by closing the load lever and moving it under the load lever retention tab.

CAUTION:

- When handling a CPU, do not touch the CPU contacts.
- The CPU is secured to the socket on the motherboard with a locking assembly.
- The CPU and motherboard are sensitive to electrostatic discharge
- Use a grounded anti-static mat and wear an anti-static wrist strap.

3. THERMAL COMPOUND

Thermal compound helps to keep the CPU cool. To install a used CPU,

- Clean the base of the heat sink with isopropyl alcohol to remove the old thermal compound.
- Follow manufacturer's recommendations about applying the thermal compound.
- Apply a small amount of thermal compound to the CPU and spread it evenly.

4. HEAT SINK/FAN ASSEMBLY

The Heat Sink/Fan Assembly is a two-part cooling device.

- The heat sink draws heat away from the CPU.
- The fan moves the heat away from the heat sink.
- The heat sink/fan assembly usually has a 3-pin power connector.
- Line up the heat sink/fan assembly retainers to the holes on the motherboard.
- Place the heat sink/fan assembly onto the CPU socket, being careful not to pinch the CPU fan wires.
- Tighten the heat sink/fan assembly retainers to secure the assembly in place.
- Connect the heat sink/fan assembly power cable to the header on the motherboard.

5. INSTALL RAM MEMORY MODULES

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

RAM installation steps:

- Align the notches on the RAM module to the keys in the slot and press down until the side tabs click into place.
- Make sure that the side tabs have locked the RAM module and visually check for exposed contacts.

6. INSTALL THE MOTHERBOARD

The motherboard is now ready to install in the computer case.

CAUTION:

- Plastic and metal standoffs are used to mount the motherboard and to prevent it from touching the metal portions of the case.
- Install only the standoffs that align with the holes in the motherboard.
- Installing any additional standoffs may prevent the motherboard from being seated properly in the computer case.

STEPS TO INSTALL THE MOTHERBOARD:

- Install standoffs in the computer case.
- Align the I/O connectors on the back of the motherboard with the openings in the back of the case.
- Align the screw holes of the motherboard with the standoffs.
- Insert all of the motherboard screws.
- Tighten all of the motherboard screws.

7. 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:

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

Drives, such as optical drives (CD and DVD) and floppy drives, are installed in drive bays that are accessed from the

front of the case.

- Optical drives and floppy drives store data on removable media.
- Drives in external bays allow access to the media without opening the case.

8. Installing OPTICAL Drive:

An optical drive is a storage device that reads and writes information to CDs or DVDs.

- Position the optical drive to align with the 5.25 inch drive bay.
- Insert the optical drive into the drive bay so that the optical drive screw holes align with the screw holes in the case.
- Secure the optical drive to the case using the proper screws.

9. INSTALL ADAPTER CARDS

Adapter cards are installed to add functionality to a computer. Adapter cards must be compatible with the expansion slot.

Some adapter cards:

- PCIe x1 NIC
- PCI Wireless NIC
- PCIe x16 video adapter card

Installing Network Interface Card (NIC):

A NIC enables a computer to connect to a network. NICs use PCI and PCIe expansion slots on the motherboard.

- Align the NIC to the appropriate slot on the motherboard.

- Press down gently on the NIC until the card is seated.
- Secure the NIC PC mounting bracket to the case with the appropriate screw.

10. 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.
- Additional cables connect the buttons and link lights on the front of the computer case to the motherboard.

Power Connector Installation Steps:

- Plug the SATA power connector into the HDD.
- Plug the Molex power connector into the optical drive.
- Plug the 4-pin Berg power connector into the FDD.
- Connect the 3-pin fan power connector into the appropriate fan header on the motherboard, according to the motherboard manual.
- Plug the additional cables from the case into the appropriate connectors according to the motherboard manual.

SATA Cable:

The SATA data cable has a 7-pin connector.

- One end of the cable is connected to the motherboard.
- The other end is connected to any drive that has a SATA data connector.

Connect External Cables:

- Attach the monitor cable to the video port.
- Secure the cable by tightening the screws on the connector.
- Plug the keyboard cable into the PS/2 keyboard port.
- Plug the mouse cable into the PS/2 mouse port.
- Plug the USB cable into a USB port.
- Plug the network cable into the network port.
- Connect the wireless antenna to the antenna connector.
- Plug the power cable into the power supply.

11. BOOT COMPUTER

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.

- A special key or combination of keys on the keyboard is used to enter the BIOS setup program.
- The BIOS setup program displays information about all of the components in the computer.

Identify Beep Codes for any hardware connection error

- 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.
- Typically, a single beep denotes that the computer is functioning properly.
- If there is a hardware problem, the computer may emit a series of beeps.

- Each BIOS manufacturer uses different codes to indicate hardware problems.
- Consult the motherboard documentation to view beep codes for your computer.

Video Link: Assembly of PC:
https://www.youtube.com/watch?v=lTFJK2E5qf0

Video Link: Installation of Windows
https://www.youtube.com/watch?v=ETK4TFzyXQI

Practical 1.3: Memories

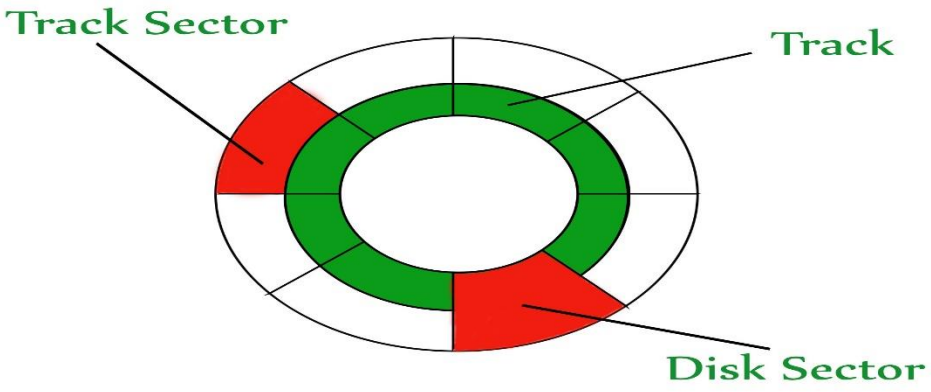
Objective: Draw a labelled sketch of Hard Disk. Explain the working principle of hard disk, also explain Spindle, Cluster, Sector, Track, Read-Write Head, Arm, Platter, Rotational Latency, Seek Time, Data Transfer Time and Average Access Time.

Material Required: Plain A-4 size Sheet, Pen.

Hard disk drive (HDD) - is a kind of mechanical device memory where data is encoded in the form of magnetic impulses on platters covered with magnetizing ferromagnetic material.

The typical HDD consists of: stepper and linear motors, read-and-write heads, platters and disk controller. The controller includes central processing unit, RAM and ROM memories and data amplifiers circuits. Communication between CPU and HDD requires transmission of data, commands (to appropriate registers of HDD controller) and status words.

A hard disk is a memory storage device which looks like this:



The disk is divided into tracks. Each track is further divided into sectors. The point to be noted here is that outer tracks are bigger in size than the inner tracks but they contain the same number of sectors and have equal storage capacity. This is because the storage density is high in sectors of the inner tracks whereas the bits are sparsely arranged in sectors of the outer tracks. Some space of every sector is used for formatting. So, the actual capacity of a sector is less than the given capacity.

Structure of HDD-

Platters:

A platter is a circular magnetic plate that is used for storing data in a hard disk. It is often made of aluminum, glass substrate or ceramic. A hard disk drive contains several platters that are mounted on the same spindle. The platters rotate when the hard disk is performing read/write operations; the rotations per minute depend on the hard disk model. The platter is very sensitive, and any contamination can often make the affected area unreadable, leading to data loss. The platter is capable of holding large amount of data.

PLATTER

SPINDLE:
A spindle is a shaft that holds rotating hard disk drive (HDD) platters in place. The term is also often used to refer to a single HDD. Spindle speed, measured in rotations per minute (RPM), is one metric used to gauge disk drive performance.

TRACK:
A track is that portion of a disk which passes under a single stationary head during a disk rotation, a ring 1 bit wide. A cylinder is comprised of the set of tracks described by all the heads (on separate platters) at a single seek position. Each cylinder is equidistant from the center of the disk.

SECTOR:
A sector is the smallest unit that can be accessed on a hard disk. Each platter, or circular disk of a hard disk is divided into tracks, which run around the disk. These tracks get longer as they move from the middle towards the outside of the disk, so there are more sectors along the tracks near the outside of the disk than the ones towards the center of disk. This variance in sectors per track is referred to as "zoned-bit recording."

CLUSTER:
A cluster is the smallest logical amount of disk space that can be allocated to hold a file. Storing small files on a file system with large clusters will therefore waste disk space; such wasted disk space is called slack space. For cluster sizes which are small versus the average file size, the wasted space per file will be statistically about half of the cluster size; for large cluster sizes, the wasted space will become greater. However, a larger cluster size reduces bookkeeping overhead and fragmentation, which may improve reading and writing speed overall. Typical cluster sizes range from 1 sector (512 B) to 128 sectors (64 KB).

Read-Write(R-W) head moves over the rotating hard disk. It is this Read-Write head that performs all the read and write operations on the disk and hence, position of the R-W head is a major concern. To perform a read or write operation on a memory location, we need to place the R-W head over that position. Some important terms must be noted here:

Seek time – The time taken by the R-W head to reach the desired track from it's current position.
Rotational latency – Time taken by the sector to come under the R-W head.
Data transfer time – Time taken to transfer the required amount of data. It depends upon the rotational speed.
Controller time – The processing time taken by the controller.
Average Access time – seek time + Average Rotational latency + data transfer time + controller time.

Video Link for Hard Disk: https://www.youtube.com/watch?v=oEORcCQ62nQ

Practical 2.1: Network Components

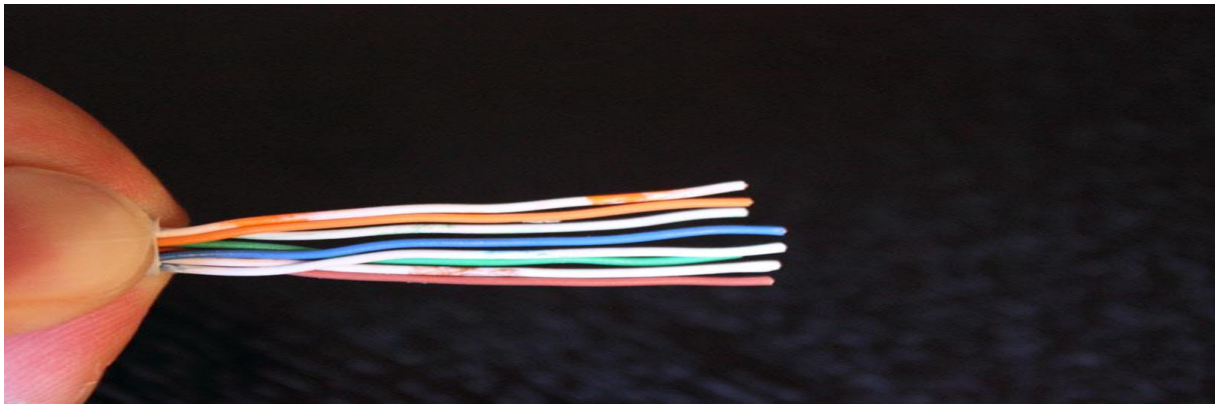
Objective: Write the steps to prepare a Straight-through network cable. **Include the snapshot/draw the sketch** of RJ-45 connector and LAN Cable.

Hint: Use the colors for showing the color of the cable.

Material Required: Plain A-4 size Sheet, Sketch Pen, Pen, Pencil.
Pick a Cat5e cable and an RJ-45 Connector.
Crimping Tool will be required to punch the cable.
There are 8 Pins available in RJ-45 Connector.

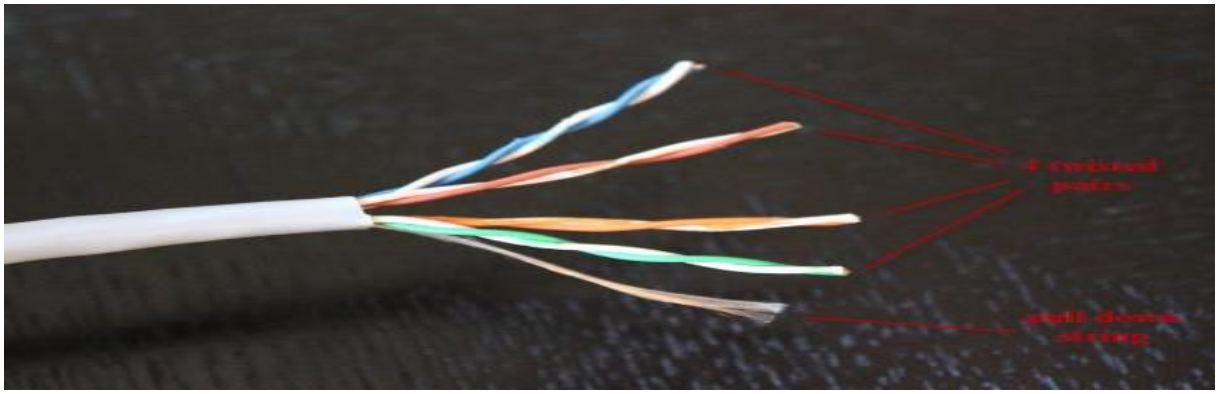
The Cable also has 8 wires into it.

- This cable has 8 small cables into it with different color codes.
- These color codes allow us to prepare Straight-through cable and Cross over cable.
- There are 8 pins in RJ-45 Connector.
- Each cable is punched into the 8 pins in the connector.

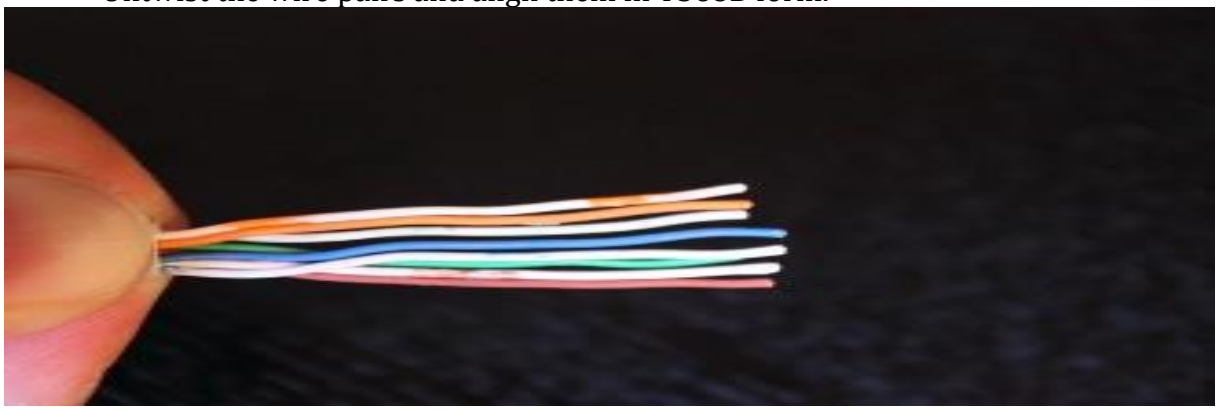


Step By Step:

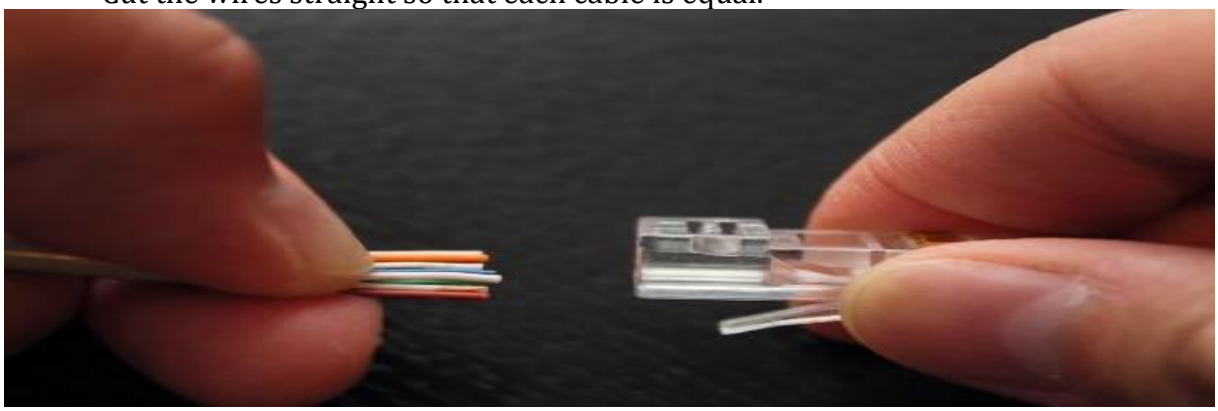
- Step-1
- Uncover the upper Sheath of the cable.
-



- Step-2
- Untwist the wire pairs and align them in T568B form.



- Step 3
- Cut the wires straight so that each cable is equal.



- Step 4
- Insert the wires in the connector according to the table discussed.

- Step 5
- Push the connector inside the crimping tool and squeeze the crimper all the way down.

•

Follow the approach for Preparing Patch/ Straight Through Cable

- Pin 1 in RJ-45 connector will be punched in with White/Orange Cable.
- Pin 2 will be punched in with Orange Cable.
- Pin 3 will be punched in with White/Green cable.
- Pin 4 will be punched in with Blue cable.
- Pin 5 will be punched in with White/Blue cable.
- Pin 6 will be punched in with Green cable.
- Pin 7 will be punched in with White/Brown cable.
- Pin 8 will be punched in with Brown cable.
- Both Side of the connector will have the same standard either T568A or T568B.

Video Link: https://www.youtube.com/watch?v=WvP0D0jiyLg

Practical 2.2: Various troubleshooting & Demonstrations

Objective: Write the steps to troubleshoot when there is an error 0xc00000e displayed to you on the screen when you switch on the PC.
Material Required: Plain A-4 size Sheet, Pen, Pencil.
To Resolve the Error Code 0xc00000e
With the following methods, you can fix the recovery error code 0xc00000e. Now, the method you opt to use will be determined by the cause of the error in your PC's case.

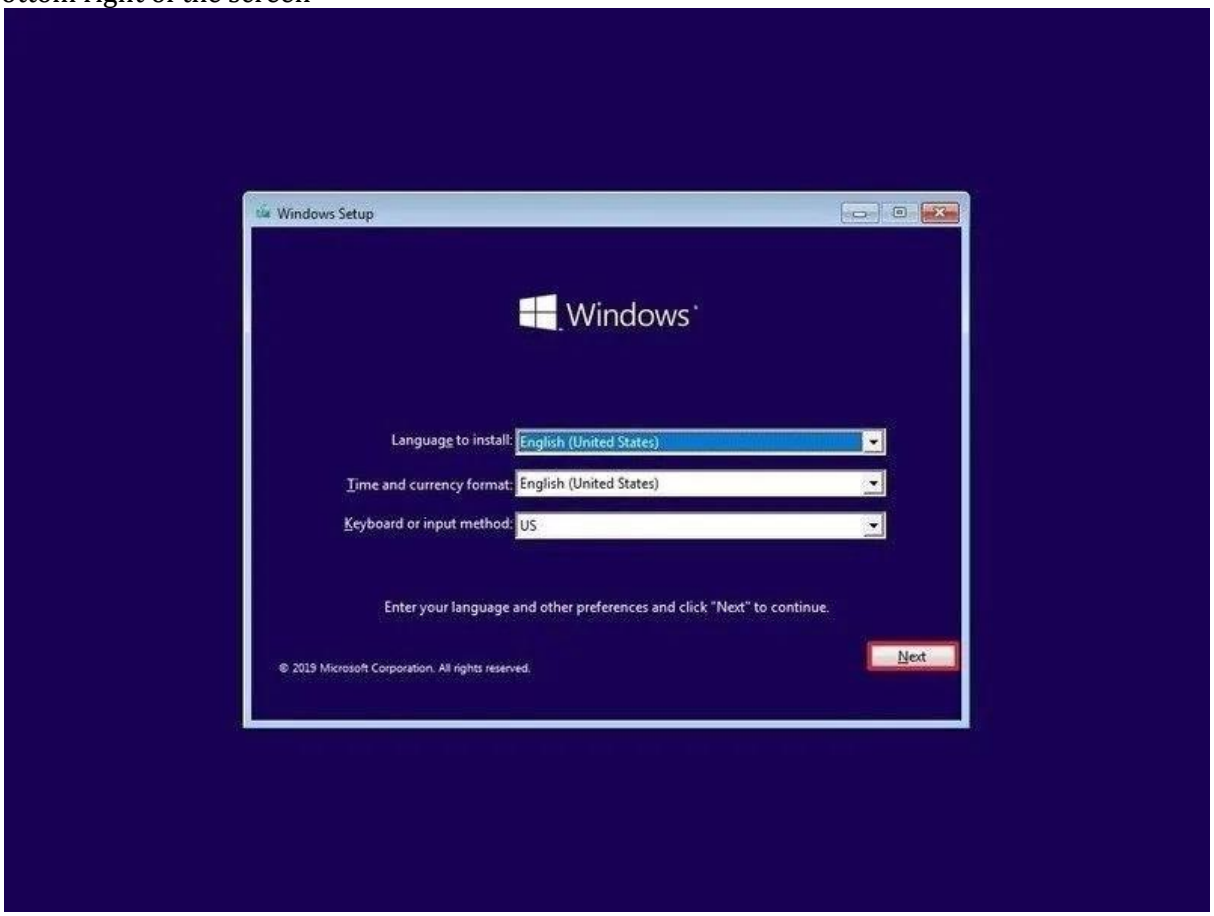
Method 1: Check Physical Device Connections
Start by checking if there are any external devices connected to your PC. This method is important because if the BIOS or UEFI are configured in such a way that the external device is higher on the scale of boot order of preference than your computer's hard disk, then it will affect the booting process. Your computer will be trying to boot into the external disk, instead of into your system's hard disk. This could lead your computer to boot into this error code 0xc00000e.

Examples of external devices that could cause such issues include CDs, Pen Drivers, DVDs, other USB Storage Devices, and so on.

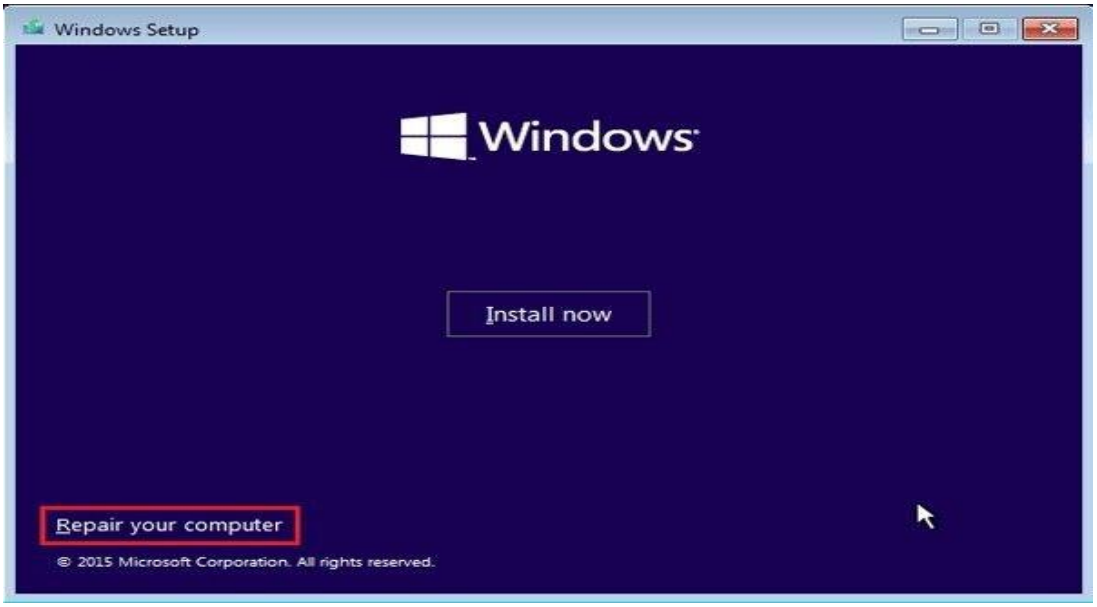
Method 2: Rebuild BCD File
The Boot Configuration Data (BCD) file contains the parameters for the boot configuration, such parameters indicate how to boot your Windows operating system. Thus, a corrupt BCD will pose a problem to your PC, leading to this error.

To rebuild your BCD file, you need to create a bootable medium from ISO, insert it into your Windows 10 computer, and follow the steps below:

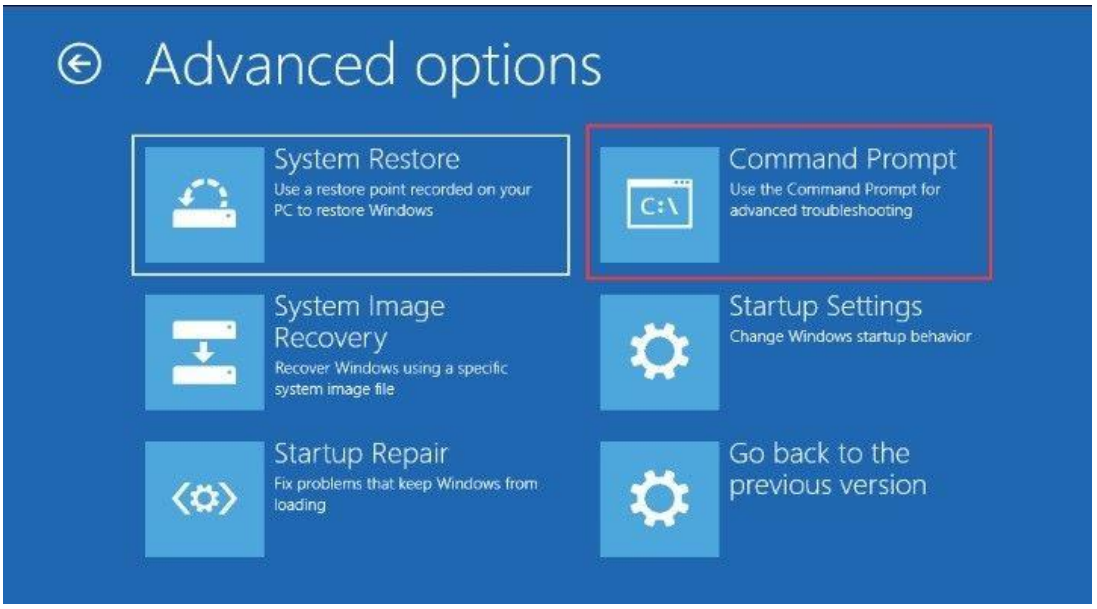
Once your computer is booting from the bootable medium you have created, choose the "Next" button you see at the bottom right of the screen



Click on "Repair your computer", the link which is located at the bottom left of your screen so you have to watch out. Do not be tempted to click the "Install now" button which is obviously at the center of the screen because that will lead you to a fresh installation of your Windows 10 OS

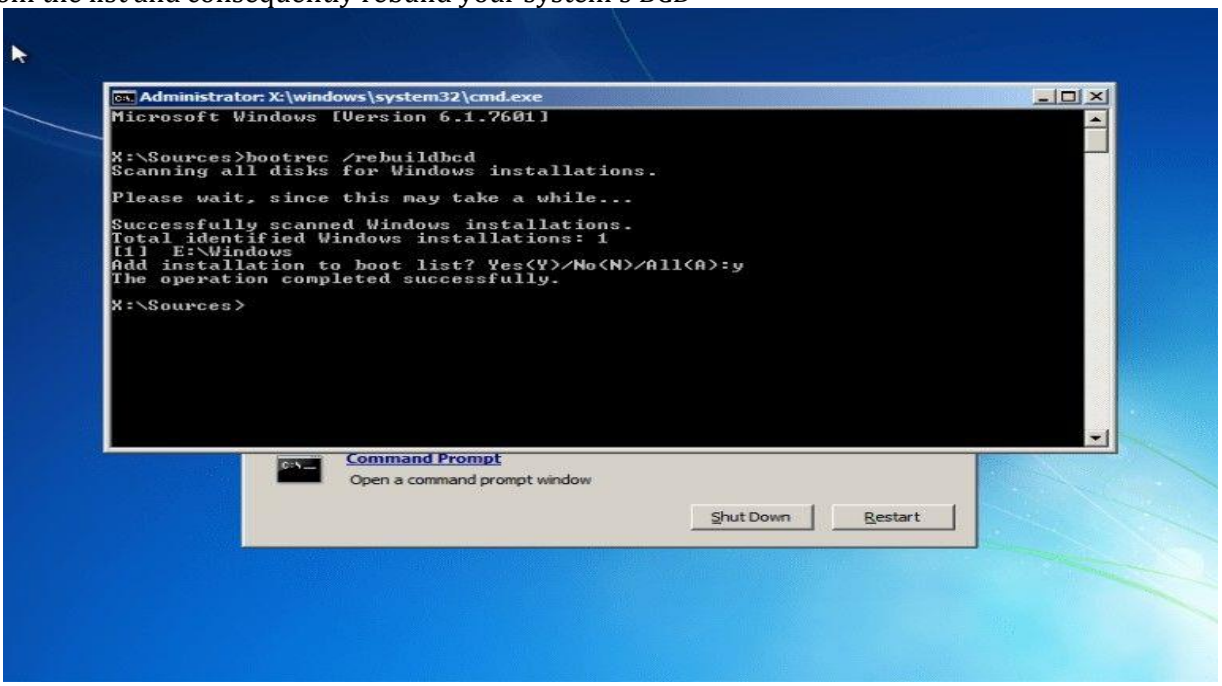


Select to begin "Troubleshoot"; then choose the "Command Prompt" tab in the list beneath the "Advanced options" window.

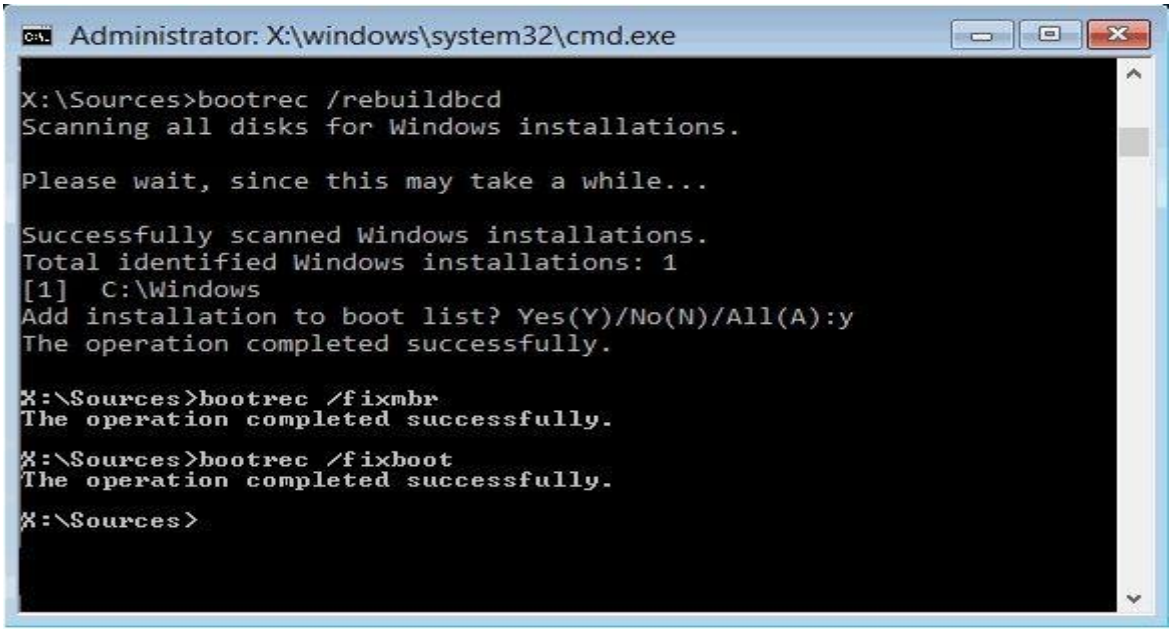


To continue, choose the account you are currently using.
Type in your computer's password if you have one

Input this command: bootrec /rebuildbcd. Now, hit the "Enter" key
When the installation is found for Windows, go to your keyboard and press the letter "Y". This will enable it to boot from the list and consequently rebuild your system's BCD

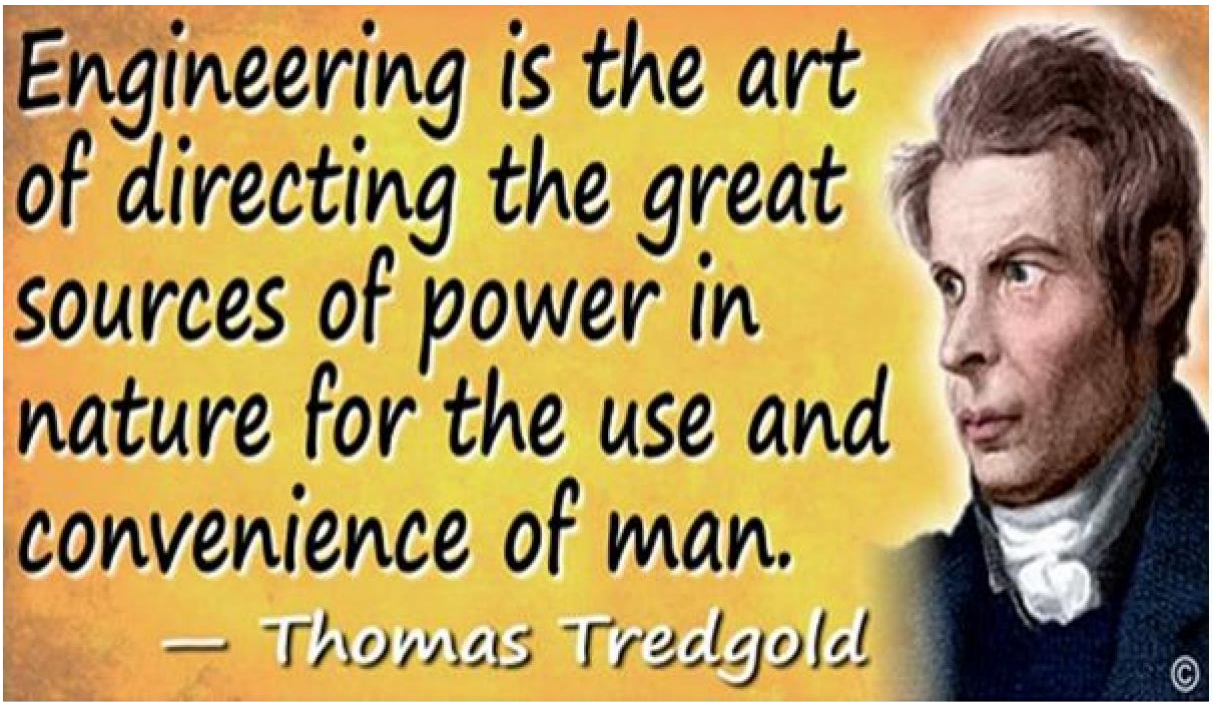


After its finished, type the following instructions, pressing "Enter" after each line"
bootrec /fixmbr
bootrec /fixboot
rebuild bcd file 6



Video Link: Error **0xc00000e**
https://www.youtube.com/watch?v=HtSKZhq3uHM

FITTING SHOP



Fitting Shop:

SAFETY PRECAUTIONS:

1. Always wear the Apron and closed shoes in the Shop.
2. Do not wear any necktie, jewelry, rings, and watches during working in the shops.
3. Do not play with the tools because they are sharp.
4. All Files should be fitted with suitable handles.
5. When using chisel its direction should be kept away from other working persons.
6. When filing apply force in forward stroke only and vice versa.
7. When using Hacksaw see that its blade is fitted to cut in forward Direction with requisite Tension.
8. Handle measuring instruments like Micrometer, Vernier Caliper, Dial Indicator and Height Gauge etc.with due care.
9. While tapping, do not apply excessive force, it may break the Tap.
10. Clean up oil and grease or other liquid which spills on the floor last they may be a cause of accident.
11. Do not drop metal pieces on Surface Plate.

Introduction to Fitting Work: It is an assembling of parts in industrial enterprises. Fitting may also be required as a part of the repair and adjustment work done on machines and their sub-assemblies in repair shops.

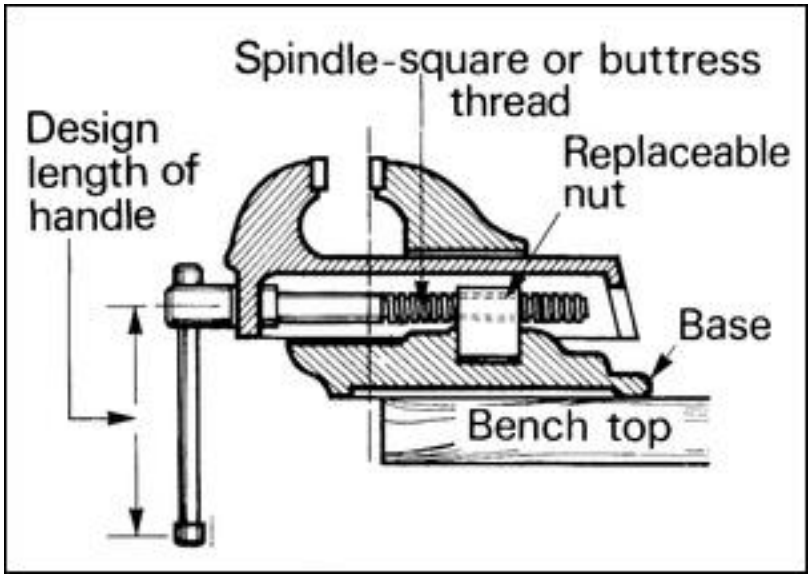
Fitting Shop: It is the Shop where fitting work is carried out manually and includes Filing, Threading, Bending and Straightening, Drilling, Countersinking, Reaming, Lapping, and Riveting etc.

Tools used in the Fitting shop:

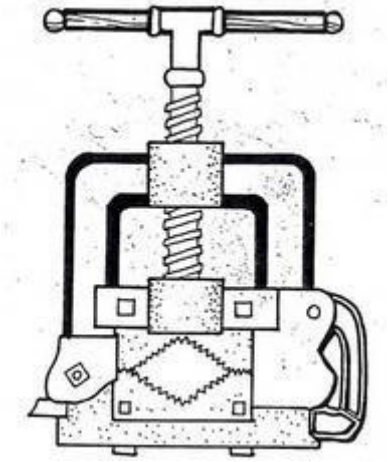
(A) The holding tools:

The Bench Vice: It is the most common type of vice used in the Fitting shop. It is used to clamp metal instead of wood. It is typically made of Cast Steel or malleable Cast Iron. The jaws are often separate and

replaceable, usually engraved with serrated or diamond teeth. An Engineer's Vice is bolted onto the top surface of a workbench.



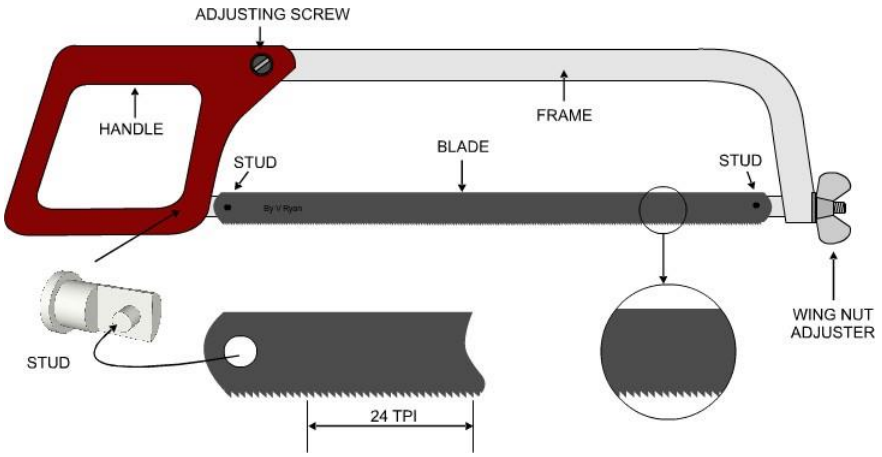
The Pipe Vice: It is used to hold small diameter pipes for Cutting and Threading etc.



The Hand Vice: it is used to hold small work pieces for filing and drilling which are otherwise difficult to hold.

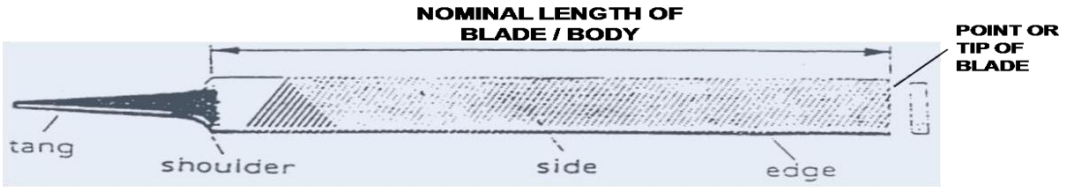
(B) The Cutting Tools:

The Hacksaw: It is used for cutting of rods, flats etc. The blade of the hacksaw is made up of high carbon steel or high-speed steel and 12" long blade is used in fixed frame hacksaw. The blade is placed inside the frame and is tightened with the help of wing nut. The teeth of blade are forward cut.



Files: Files of different types are the principal cutting tools used in the fitting shop. Files are generally made of high carbon steel.

a) Parts of a File:



b) Classification of files: files are classified according to

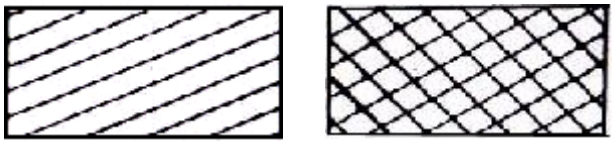
i. Length varying from 10 cm to 40 cm.

ii. Shape i.e., flat, round, half round, knife edge, square file etc.

iii. Grade i.e., rough, bastard, second cut, smooth, dead smooth

iv. Cut i.e., single cut, double cut

c) Cut of a File: These cuts are selected according to the material of the work piece, the desired removal ofmaterial and the surface finish.



Single Cut Double Cut

d) Grade of a File: Grade of a file means no of teeth per unit length. As per grade files are classifies as

i. Rough file having 8 teeth/cm

ii. Bastard file having 12 teeth/cm

iii. Second cut file having 16teeth/cm

iv. Smooth file having 20-24 teeth/cm

v. Dead smooth file having 40 or more teeth/cm

e) Some common types of Files

i) FLAT FILE: Used for general filing of metals such as Steel. They are rectangular in section and are the most common type of file used in workshops.

ii) HALF ROUND FILE: Used for filing curved surfaces. A normal hand file with its flat cutting edgesis unsuitable for filing curved surfaces. However, the half round file has a curved surface which is especially useful for filing internal curves.

iii) THREE SQUARE FILE: Is triangular in section and very useful when filing ‘tight’ corners / angles.The sharp edges allow the file to fit into corners when filing.

iv) KNIFE EDGE FILE: Knife files are very useful when filing where there is little space. Knife files are very thin and can fit into small gaps.

v) SQUARE FILE: The square file is quite thin and fits into corners well. They can be used to file slotsin metal or for filing where there is little space.

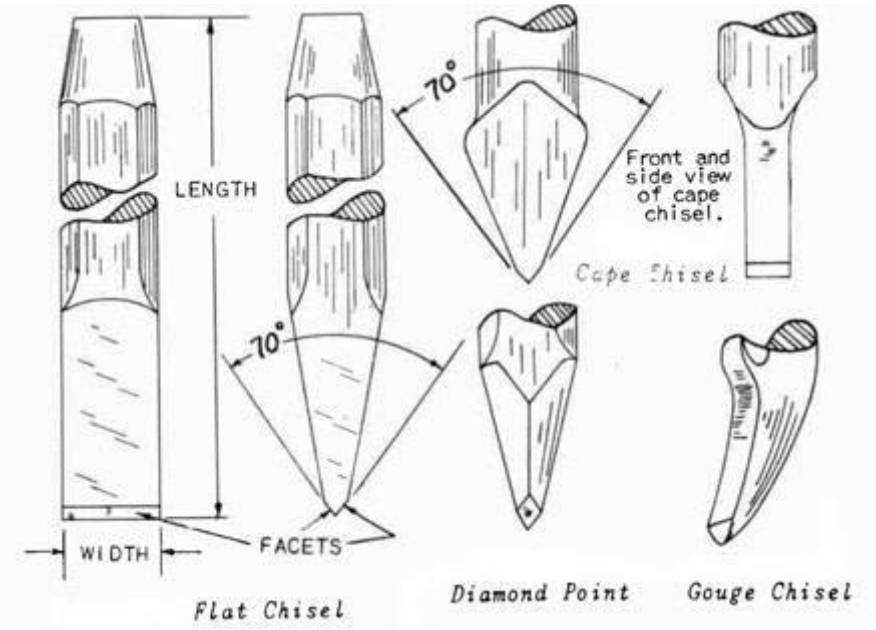
Cold Chisels: There are four common types of cold chisel.

i) The F**lat Chisel**, the most widely known type, which is used to cut bars and rods to Reduce surfaces andto cut sheet metal which is too thick or difficult to cut with tin Snips.

ii) The C**ross Cut chisel/Cape chisel** is used for cutting grooves and slots. The blade narrows behind thecutting edge to provide clearance.

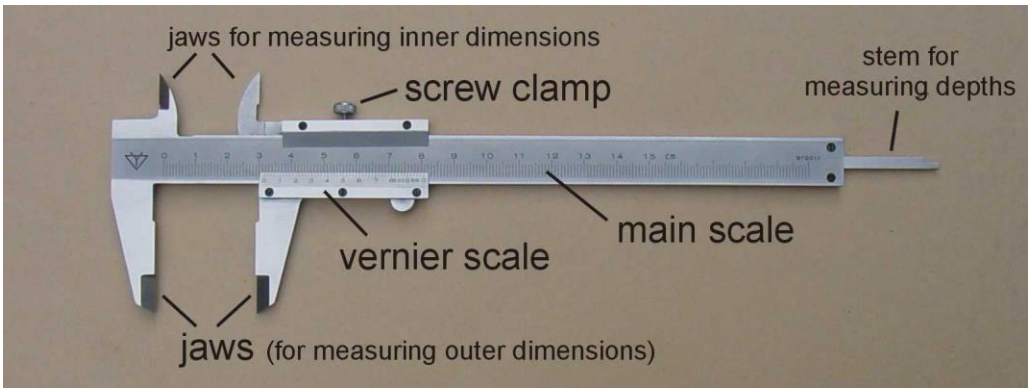
iii) The R**ound Nose Chisel** is used for cutting semi-circular grooves for oil ways in Bearings.

iv) **The Diamond Point Chisel** is used for cleaning out corners or difficult places and pulling over centrepunch marks wrongly placed for drilling.



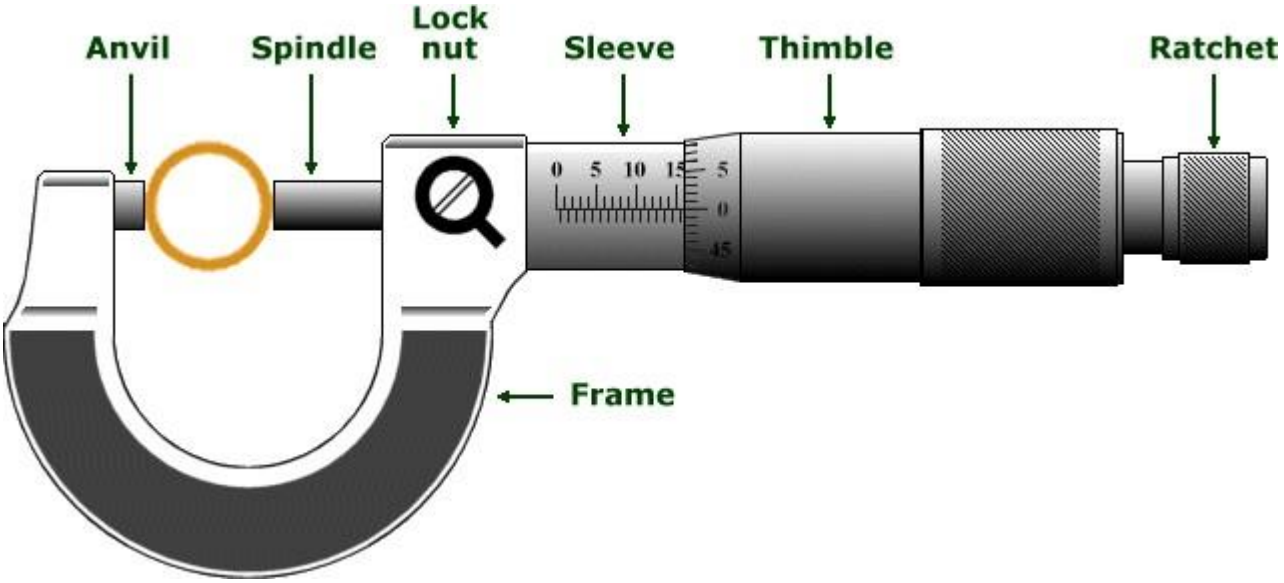
(C) The Measuring and Marking Instruments and Tools:

i) Vernier Caliper: It is a precision instrument used for measuring lengths and diameters. It can be used for measuring internal and external dimensions. The least count of Vernier Caliper is 0.02mm. Generally, the material of all parts is stainless steel.



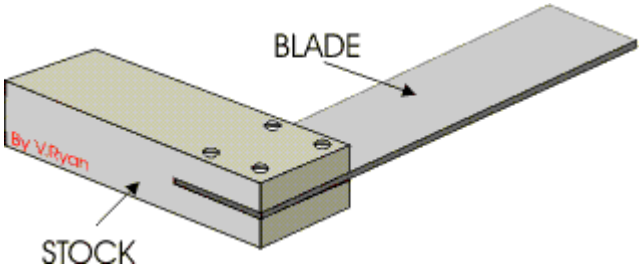
ii) Micrometer: A **micrometer** also known as a S**crew Gauge** is a device having a calibrated screw widely used for precise measurement of components in mechanical engineering. The three most common types of micrometers; are

- **Outside Micrometer** used to measure wires, spheres, shafts, and blocks.
- **Inside Micrometer**, used to measure the diameter of holes.
- **Depth Micrometer** used to measure depths of slots and steps.

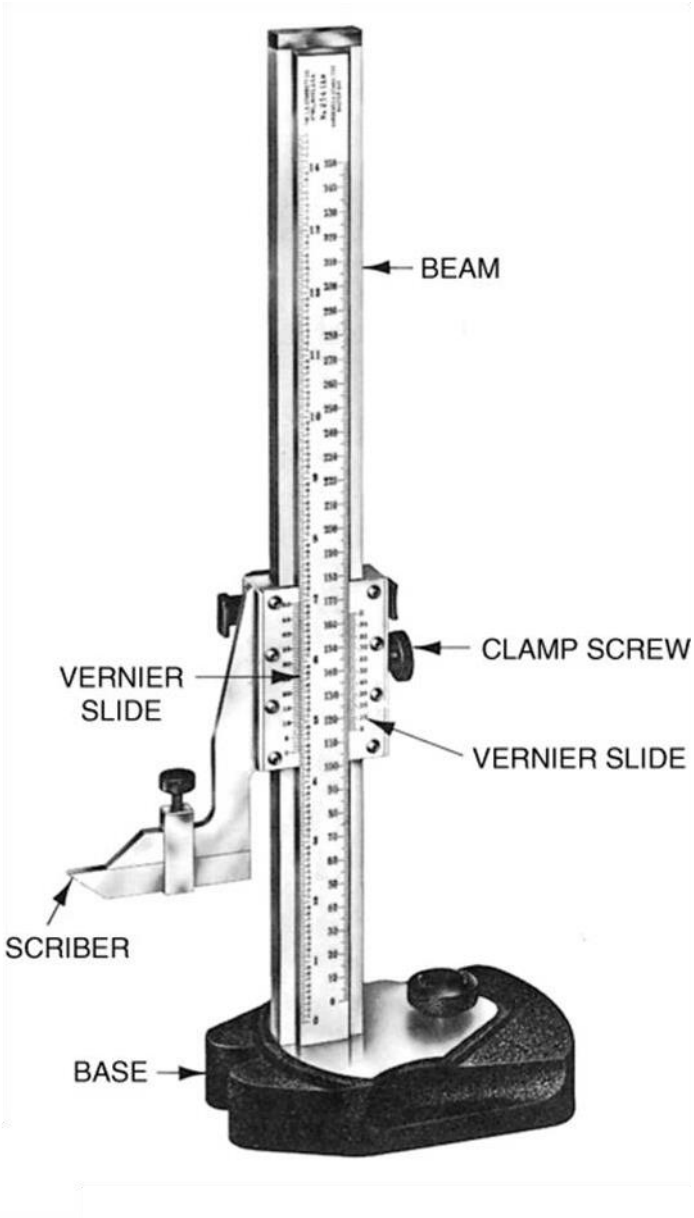


An outside Micrometer

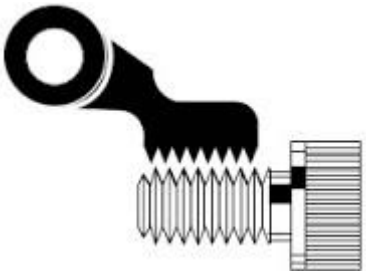
iii) Try Square: it is used to measure 90ºangle.

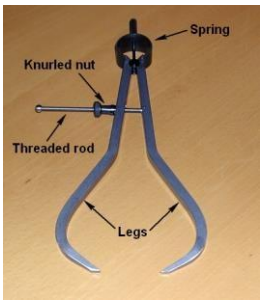


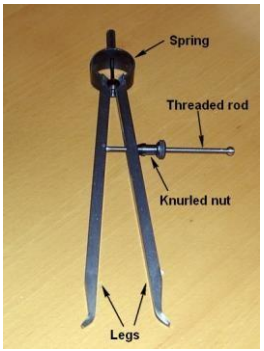
iv) Height Gauge: It is used for marking lines on a work piece at specific height and to measure the height of work piece. It is always used by placing it on surface plate. The base of the height gauge is made up off cast iron and the beam is made up of stainless steel.



v) Thread Pitch Gauge: it is used to check pitch of the thread on the nuts and bolts.





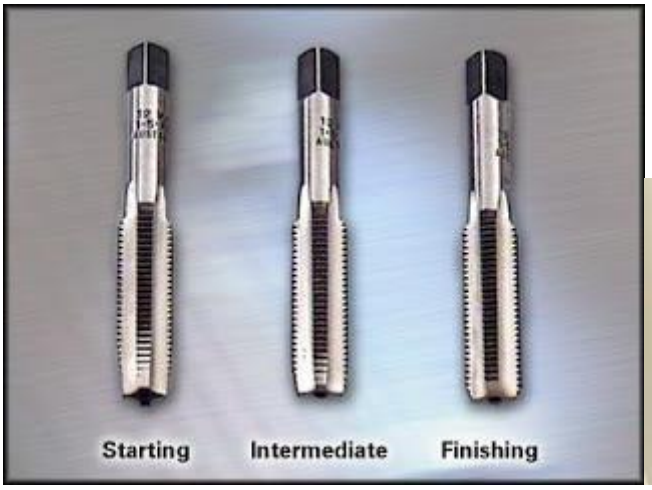


vi) The Outside Spring Caliper: are used for measuring external dimensions such as the length, diameter,or even the thickness of a solid.

vii) The Inside Spring Caliper: These are used for measuring internal dimensions such as the diameter ofa hole, or the width of a slot etc

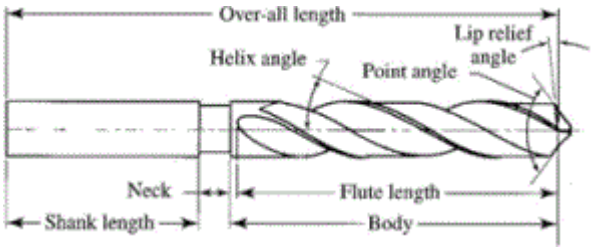
(C) Some Other Important Tools and Devices:

i) Taps: Hand taps are used for making internal threads in the Fitting Shop. The hand taps come in a set ofthree pieces. The taps are used in a sequence of starting, intermediate, and finishing.

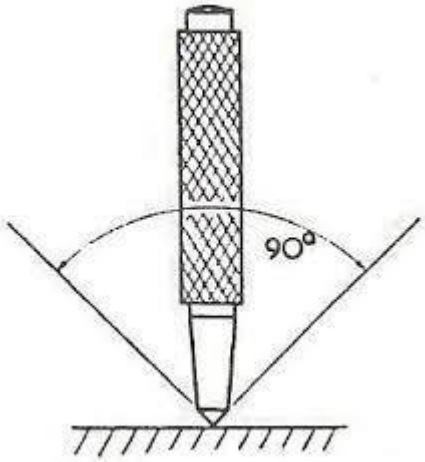


ii) Surface Plate: It is used for testing the flatness, trueness of the surface. It is made up of cast iron or granite. Its upper face is flat to form a very smooth surface. This plate is used as a base for V-block, sine bar etc. and other measuring instruments during measurement.

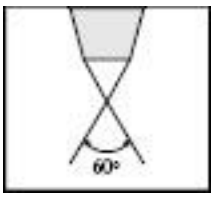
iii) Twist drill: The tool used for making new round holes or to enlarge the premade holes is called a twist drill. It is made up of high-speed steel.



iv) Centre Punch: It is used to mark the centre of a hole before drilling. It is made up of high carbon steel. One end is sharpened; Hammering is done on the second end while working. Angle of the punching end is 90°.



Centre Punch



Dot Punch

v) Dot Punch: It is like a Centre Punch except that the angle of the punching end is 60°. It is used formarking dotted lines.

Practical Exercise No. 2.3:

Objective: To make a job to controlled dimensions, involving different operations like, marking, measuring, punching, hack sawing, filing, drilling and tapping & Radiusing etc.

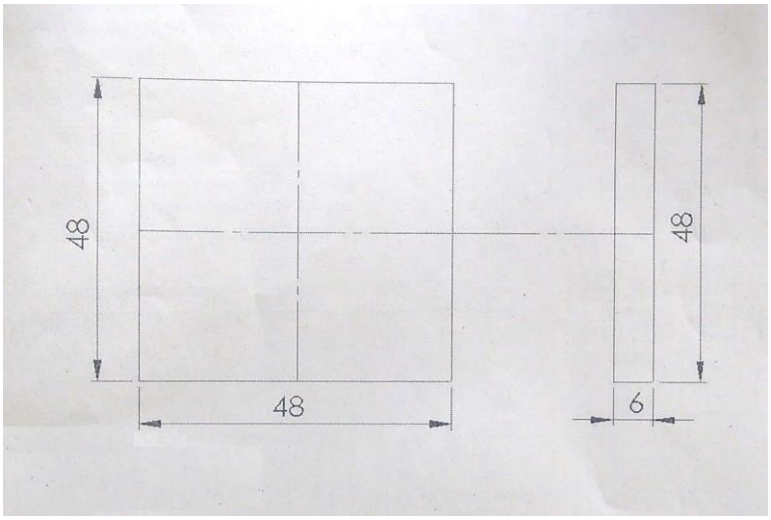
Tools and equipment used: File, Hand hacksaw, Bench Vice, Twist Drill, Try Square, Drilling Machine, Surface Plate, Angle Plate, Vernier Caliper, Vernier Height Gauge, Round File, Half Round file,

Dot Punch, Triangular File & Hammer.

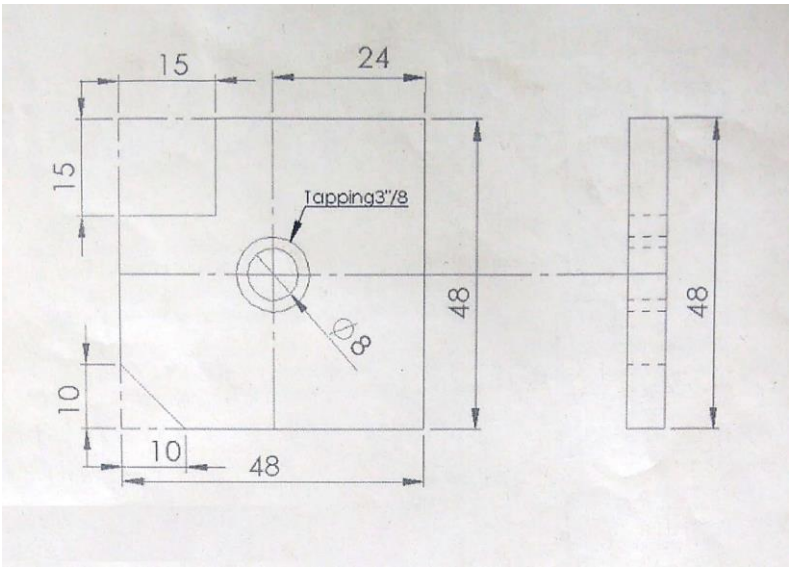
Material required: Mild Steel flat 50x50x6 mm.

Procedure:

1. Cut a work piece of 50x50mm from the given flat using Hand hacksaw.
2. Hold it in Bench Vice and file two adjacent sides. Check that these two sides are at right angle.
3. Mark for dimensions 48x48mm, using a height gauge, taking the two filed sides as reference.
4. Use prick punch to firm up the marking lines.
5. File all the four sides to the size 48x48mm and check for the squareness of the sides.
6. De burr all the sharp corners.



7. Do marking for the inclined cutting, square cutting and the tapped hole using Height Gauge.
8. Drill a tap hole of size 8mm using the Bench Drilling Machine.
9. Do tapping in the hole using a tap of size (3/8'').
10. Deburr and finish using a second cut file.



Observations:

Designed Parameters	Observed parameters	Measuring Instrument Used
Length 48mm		Vernier caliper
Width 48 mm		Vernier caliper
Thickness 6mm		Vernier caliper
Flatness of the sides		Vernier caliper
Perpendicularity of the sides		Try Square
Overall finish		Visual

Sample Viva questions with Answers for Fitting Shop:

1. What is the Material of Hacksaw blade? ***HCS/HSS***

2. Classify tools used in the Fitting Shop***. (i) Holding tools (ii) marking and measuring tools (iii) cutting tools and (iv) striking tools.***

3. Surface plates are made of***. Grey Cast Iron or granite***

4. Name some holding tools***. Bench vice, hand vice, pin vice, pipe vice and machine vice.***

5. Name some measuring instruments used. ***Vernier height gauge, Vernier Caliper, micrometer, bevel protractor.***

6. Most important cutting tool in Fitting Shop is. ***A File***

7. Files are made up of***. High Carbon steel (HCS)***

8. How to classify a File. A File is classified ***according to its (i)length(ii)shape(iii)grade(iv) cut***

9. Operation of making internal threads in the Fitting Shop is called. ***Tapping***

10. Operation of making external threads in the Fitting Shop is called. ***Dieing***

11. Which is the first standardized thread system in the world. ***British standard Whitworth (BSW) thread.***

12. Who standard the BSW thread? ***Sir Joseph Whitworth of England.***

13. Difference between Iron and steel. ***Iron is an element soft and low in strength. Steel is an alloy of Iron, carbon, andother alloying elements.***

14. What is mild steel? ***Steel with carbon up to 0.25%***

15. What are different chisels used***. Flat chisel, crosscut chisel, diamond chisel etc.***

16. Thread size M12 means***. Metric thread having 12mm major diameter with standard pitch.***

17. What are the important thread parameters? ***Major diameter, Minor diameter and Pitch are the important threadparameters.***

18. How to check pitch of a thread? ***By using a thread pitch gauge.***

19. What is the use of a Feelers Gauge? ***It is used to check gap between to mating surfaces.***

20. What is drilling? ***Making new hole or enlarging the premade hole using a multipoint cutting tool called Twist Drill.***

21. What is reaming? ***Operation of correcting the size and geometry of drilled hole using a cutting tool called Reamer.***

22. Size of Hole drilled before tapping ***Tap hole size.***

23. ***What is tap hole size for M12. It is (major dia.-pitch) i.e.,12.00-1.75=10.25mm***

24. Different methods of filing***. (i)straight filing(ii)Cross filing(iii)draw filing.***

25. File used for wood working***. Rasp file***

26. Function of a surface plate***. To check flatness of a surface.***

27. What is center punch***? Punch used to mark center for drill to take exact position.***

28. Point angle of center punch***.90deg.***

29. Prick punch/dot punch***. Punch to mark dots for marking on a job.***

30. A chisel is specified by its***. (i) length (ii) width of cutting edge.***

31. What is meant by a grade of a file? ***no. of teeth /unit length***

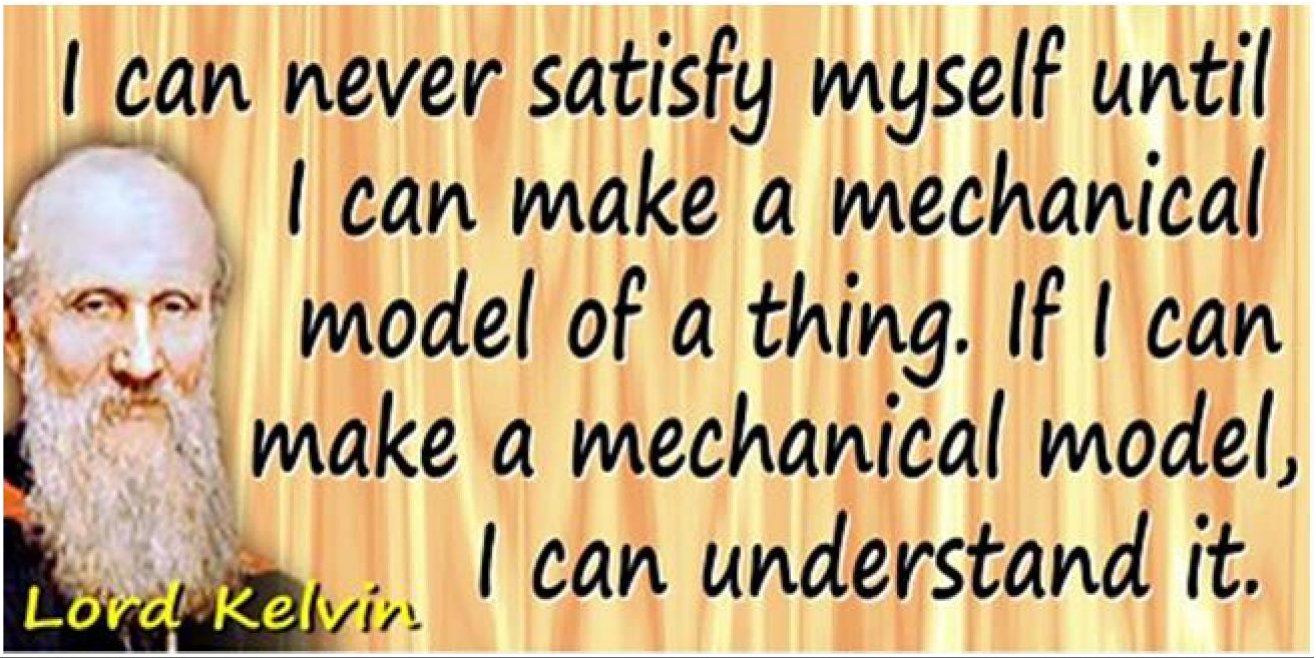
32. Name some files as per shape***. Flat file, round file, square file, half round file, knife edge& triangular file.***

33. What is safe edge file***? A file having no teeth on its edges.***

34. What is the concept of interchangeability? ***The ability to select components for assembly at random and fit themtogether within proper tolerances.***

35. *What is engineering tolerance*? ***It is the permissible limit of variation in a physical dimension.***

SHEET METALSHOP



Sheet Metal Shop:

SAFETY PRECAUTIONS:

1. Handle sheets very carefully. Sharp edges can cause cuts and even serious injuries.
2. Do not drop sheet shavings on the ground. These can penetrate shoes and cause injuries.
3. Wear closed shoes with rubber sole in the sheet Metal shop.
4. Use soft hammer or mallet to work upon sheets, hard hammers can damage or even cut the sheets.
5. Never do excessive hammering of sheets it can cause warping.
6. Use sharp scriber for marking, use of pencil should be avoided.
7. Keep checking the dimensions from time to time during layout marking and shearing.
8. Use appropriate stake for your work.
9. Make sure your work is not affecting others.
10. Seek medical care in case of cut or injury immediately.
11. Keep your mind engaged.

Introduction: Sheet metal is a metal formed by industrial processes into thin, flat pieces normally called sheets. It is one of the fundamental forms used in metalworking and can be cut and bent into a variety of shapes. Countless everyday objects are constructed from sheet metal. Thicknesses can vary significantly; extremely thin thicknesses are considered foil or leaf, and pieces thicker than 3 mm are considered plate. Sheet metal is available in flat pieces or coiled strips. Sheet metal is used for car bodies, airplane wings, medical tables, and roofs for buildings, air conditioning ducts, tubs, funnels, storage tanks and many other

applications. Sheet metal of iron and other materials with high magnetic permeability, also known as laminated steel cores, has applications, in transformers and electric machines.

Types of sheets used in sheet metal shop:

Ferrous Sheets: These are two types

a. Coated Sheets:

i. **Galvanized Iron Sheet:** It is an Iron sheet coated with zinc.GI Sheet is used for making of AC Ducts,Buckets, and boxes etc.

ii. **Tin sheet:** It is an Iron sheet coated with Tin. It is used for making Tooth paste tubes, Coca Cola cans andcontainers for edible oil and ghee etc.

b. Uncoated Sheets:

i. **Black Iron Sheet (mild steel sheet):** It is used for making almirahs, water tanks, agricultural parts, vehiclebodies and refrigerator bodies etc.

ii. **Stainless Steel sheet:** SS sheet is used for making Kitchen Ware, machinery and containers for foodindustry and chemical industry.

Non-Ferrous Sheets:

i. **Aluminum Sheet:** Due to its light and resistance to corrosion it finds applications for making airplanebodies, doors, and windows, cook ware and fancy fitting etc.

ii. **Brass Sheet:** Due do its ability of getting bright shine it is used for making scientific equipment andmodels, fancy fitting, and utensils etc.

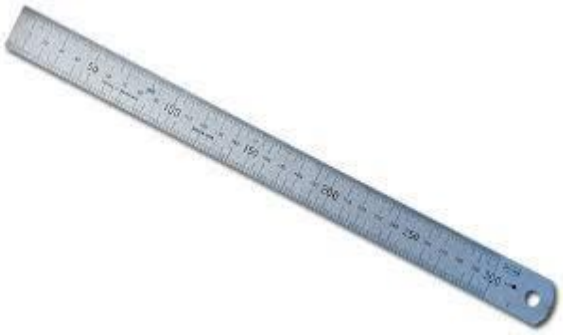
iii. **Copper sheet:** Copper being the very good electrical conductor it is used for making contacts in switches,thermostats, electrical appliances and as a base in cook ware due to it better thermal conductivity.

iv. **Lead Sheet:** It is for making containers for storing and transportation of acid and very reactive chemicals.

<u>Tools used in sheet metal Shop</u>:

(a) Marking and measuring tools:

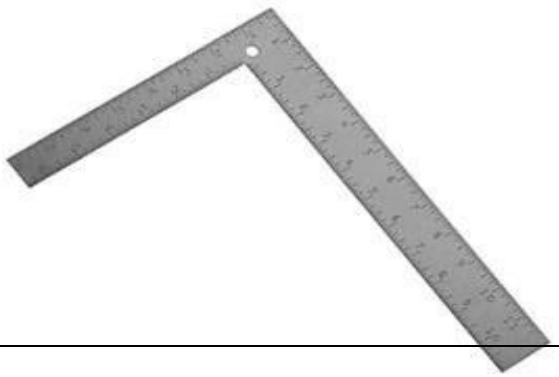
i) Steel Rule: It is basic a instrument for general measurement of linear dimensions and to draw the



lines.

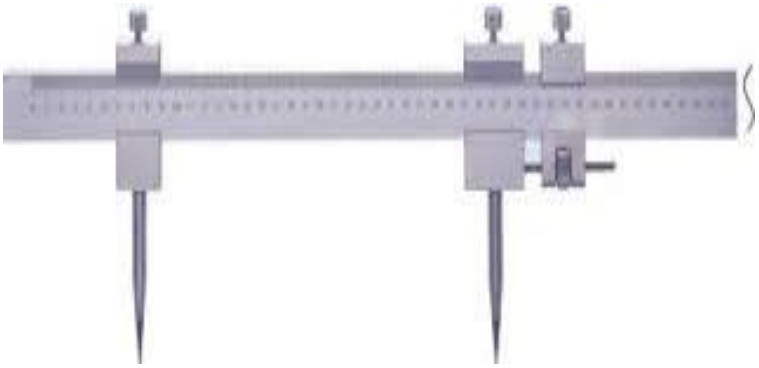
ii) Scriber: It is used to mark thin lines on sheets.

iii) Tin Mans Square: It is Try Square having uniform thickness.



iv) **Wing Compass:** It is used for drawing arcs and circles on sheets.

v) **Trammel Points:** It used to mark large circles on the sheets.



vi) **Standard Wire Gauge:** It is used to measure the thickness of sheet and diameter of wire.

(b) **Striking Tools:**

i) **Riveting hammer**: It is used for heading the rivets in riveted joints.

ii) **Raising hammer**: This hammer features two wide, flat rectangular faces designed to create seamlessforms in metal without thinning.

iii) **Mallet**: It is the soft faced striking tool used for working on sheets.

(c) **Punching cutting and shearing tools:**

i) **Hollow punch:** It is used for making circular holes in sheets.

ii) **Solid punch:** It is used for making small circular holes in sheets.

iii) Flat Chisel: It is used for cutting Sheet, Rivets and Bolts etc. Its cutting-Edge angle is 40-45°. FlatChisel is made of high carbon steel (HCS).

iv) Straight snips: It is used for cutting along a straight line.

v) Bent snips; It is used for cutting along a curvature.

vi) Lever Shearing Machine: It is used to cut long sheets.

(c) Supporting tools:

Stakes: These are very useful group of tools used to form sheet metal into various shapes. They work as supporting cum forming tools. Some of these tools are explained below:

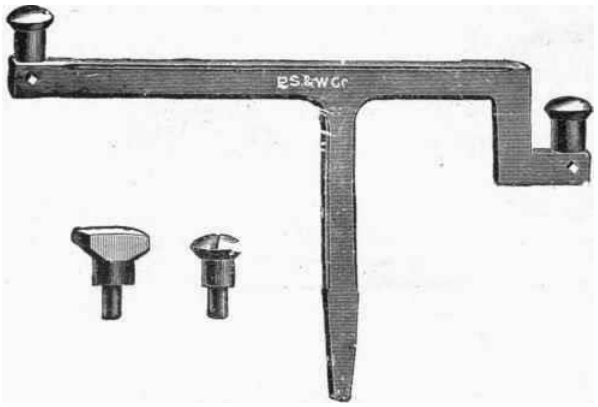
i) Bick iron: It is used in forming long tapered cylindrical items.

ii) Hatchet stake: It is used for forming, bending, and seaming of the edges.

iii) Funnel stake: It is used for making conical items.

iv) Half-moon stake: It is used for working on the edges of the discs.

v) Pipe stake: It is used for forming tubes and cylindrical jobs.



vi) Horse head stake: It is used for bending and general work for supporting & holding other stakes

Sheet Metal joints: It is the process of joining sheet metal parts together by various means. Different joints are used to join parts depending upon the requirement.

i) Lap joint
ii) Seam joint
iii) Locked seam joint
iv) Hem joint
v) Wired edge joint
vi) Cup or circular joint
vii) Flanged joint
viii) Angular joint
ix) Cap joint

Sheet Metal operations:

i) Laying out: It means operation of scribing the development of surface of the product on the sheettogether with the added allowances for overlapping, bending and hammering etc.

ii) Cleaning: It is the process of cleaning the sheet by mechanical and chemical means. It is required forproper working and handling.

iii) Marking and measuring: It is done to draw the dimensions of the Layout on the sheet.

iv) Cutting and shearing: It is the process for cutting the marked part from the sheet.

v) Edge forming and wiring: The edges of a sheet metal parts are formed for safety of hands to provide stiffness. For still stronger edges they are reinforced by inserting a wire and then forming the edge around it.

vi) Joint making: It is the process of joining sheet metal parts together by various means.

vii) Bending: It is the process to give different angles and curvatures to the sheet for the require form.

viii) Soldering and brazing: Soldering is method of joining sheet metal parts with the help of a low melting point alloy called Solder. Brazing uses an alloy called Spelter to joins sheet metal parts. Brazing is stronger than soldering.

Practical Exercise No. 2.4(a):

Objective: To make different sheet metal joints.

Raw Material: G.I. sheet of 28 SWG.

Tools Required: Flat Steel plate, Hand Shears, Steel Rule, Steel Square, Scriber, Mallet, Soft Face Hammer, Try square, and Stakes.

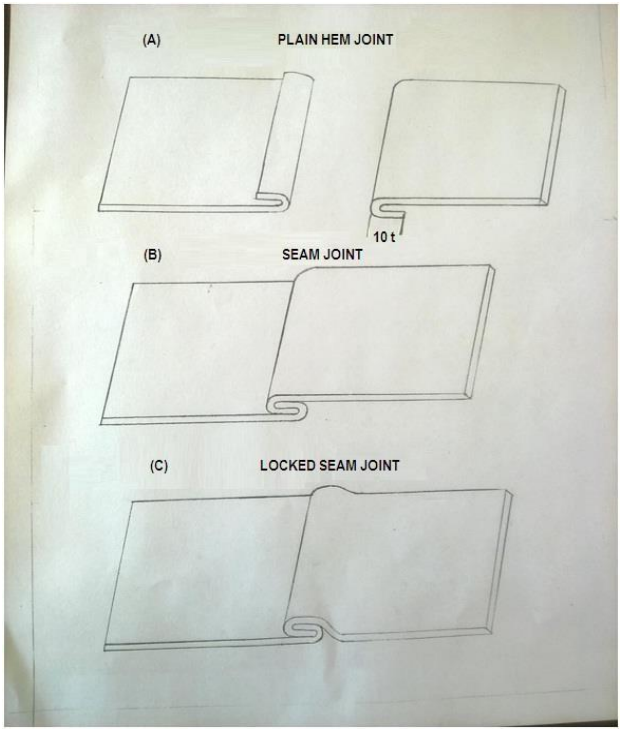
Different Sheet Metal Joints: According to the requirements many different types of joints are used in sheet metal work.

Hem Joint: It is wired edge, cup and angular enables the edges to join the pieces along them. **Seam joint** is a very commonly used one and most widely used methods for joining light- and medium-gauge sheet metal. It consists of two folded edges that are locked together with a hand groover.

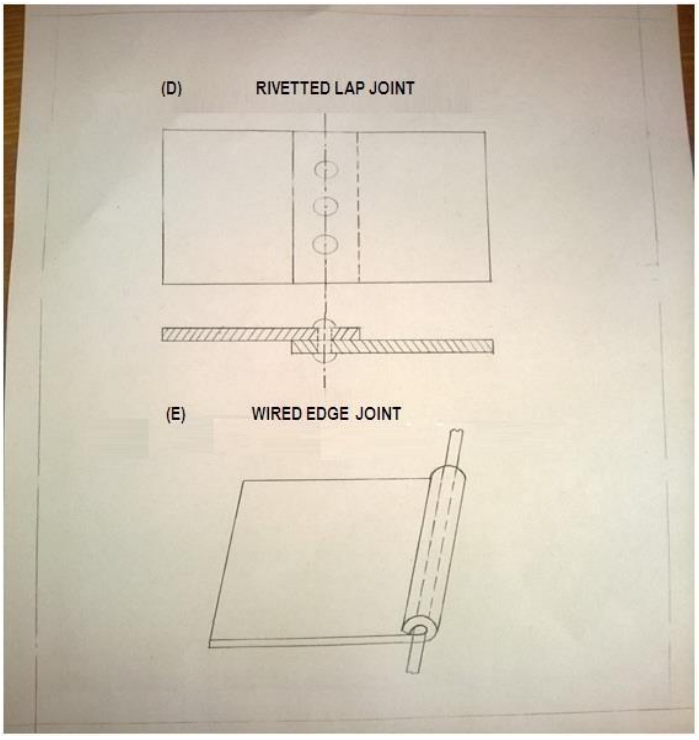
Locked Seam Joint: Seam joint is locked so as to ensure a positive grip and also to make the joint flush with the surface.

Lap joint: It is very frequently used and can be prepared by means of soldering or riveting. A lap joint involves placing one piece of sheet metal over another, "lapping" it. Lap joints are among the strongest joints available.

Wired Edge Joint: It is often specified in the plans, Objects, such as ice-cube trays, funnels, garbage pails, and other articles, formed from sheet metal are fabricated with wire edges to strengthen and stiffen the jobs and to eliminate sharp edges. The formula for a wired edge is 1½ x diameter of wire minus 1 or 2 metal thickness approximately.



Sheet Metal Diagram – I



Sheet Metal Diagram – II

Practical Exercise No. 2.4(b):

Objective: To make a Rectangular Tray.

Raw Material: G.I. sheet of 28 SWG.

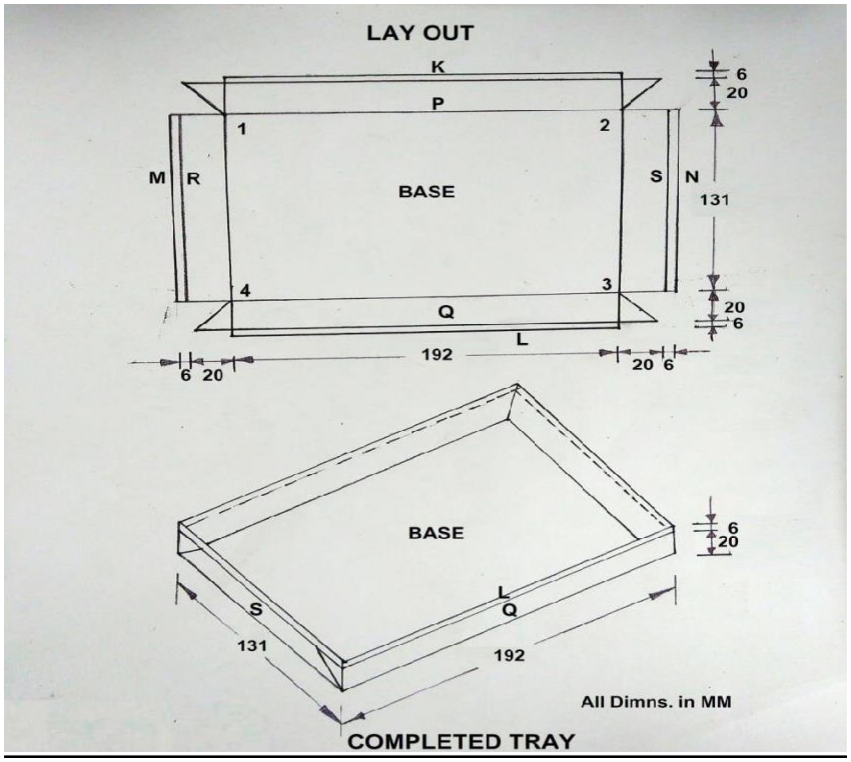
Tools Required: Flat Steel plate, Hand Shears, Steel Rule, Steel Square, Scriber, Mallet, Soft Face Hammer, Try square, and Stakes.

Procedure:

1. Mark and cut piece of size 244 mm x 183 mm from the given G.I. sheet.
2. Place it on the flat surface and straighten with the help of the mallet, and soft face hammer (if required).
3. The layout of the required tray is given in figure III. Mark it on the straightened piece and check all thedimensions properly.
4. Cut away the unwanted material from the metal piece to obtain the final figure, as shown in layout fig. III
5. Again, straighten the piece and check it dimensions, make necessary corrections, if needed.
6. Using suitable stake and soft face hammer/mallet, bend the surface P, Q, R, S along the lines 1-2,3-4,2-3and 1-4, to make them perpendicular to horizontal base of the tray.
7. In the same way, bend the four triangular surfaces along the vertical edges of surface R and S.
8. Check the squareness of the entire four bent surface, with reference to the rectangular base of the tray, bymeans of a try square.
9. Finally bend the smaller rectangular surface K, L, M and N at 180^o outwards for edge folding.
10. This, in addition to providing reinforcement and rigidity to the tray, will also avoid the sharp edgesmaking handling safe.

Precautions:

1. To avoid injury to hands by the sharp edges and corners of the cut piece, always work carefully.
2. Periodically check squareness of all adjacent surfaces, during the operation.
3. Use mallet or soft hammer on sheets.
4. Hammering, punching or similar other striking operations should not be done on a surface plate to avoidspoiling of its top surface.



Sheet Metal Diagram – III

Observations:

Required Parameters	Observed parameters	Measuring Instrument Used
Length 238mm		Steel rule
Width 138mm		Steel rule
Height 20mm		Steel rule
Edge Folding 6mm		Steel rule
Perpendicularity		Try Square
Sharp Edge, dents		Visual
Overall Finish		Visual

Viva questions for Sheet Metal shop:

1. Differentiate between foil, sheet, and plate***. Foil thickness up to 0.152 mm, sheet thickness from 0.152mm up to 3 mm and plate from 3 mm onwards***

2. What is GI sheet? ***It is galvanized Iron sheet***

3. What is galvanized Iron sheet? ***Iron sheet coated with zinc.***

4. What are applications of GI sheet? ***It is used in making, almirahs, buckets, AC ducts, and vehiclebodies.***

5. What are the applications of brass sheet? ***Now a days it is mainly used for decorative purposes.***

6. Galvanizing is done***. To protect iron sheet from corrosion.***

7. Why G I sheet metal should not be welded? ***Poisonous gas will be produced at elevated temperature.***

8. What is tin sheet? ***Iron sheet coated with Tin.***

9. What are the applications of Tin sheet***? Containers for edible oils and coke cans etc.***

10. Uses of aluminum sheet***. Airplane bodies, kitchen, and household items etc.***

11. Uses of lead sheet. ***Used as cladding in containers for holding acids.***

12. Uses of SS sheet***. Used in making kitchen ware, food handling equipment, dairy equipment, chemicalplants, and food processing equipment.***

13. How thin sheets are manufactured? ***Using process called Cold Rolling.***

14. What is supporting tool used in Sheet metal shop called***? A stake***

15. Different types of stakes***. Bick iron, hatchet stake, half-moon stake, pipe stake, horse head stake***

16. What is mallet? ***It is a soft hammer made of wood, nylon, plastic or hide etc.***

17. Name some sheet metal operations. ***laying out, Measuring, and marking, nibbling, piercing, blanking,edge forming and wiring, joint making, soldering, and brazing etc.***

18. Some joints used in sheet metal shop***. lap joint, seam joint, locked joint, wired edge joint, cup orcircular seam joint, flanged seam joint etc.***

19. Classification of sheet metal tools. ***(i) supporting and striking tools (ii) punching cutting and shearingtools(iii)marking and measuring tools***

20. Name some marking &measuring tools***. scriber, wing compass, trammel points, steel square***

21. Cutting tools***. straight snip, bent snip***

22. What is nibbling? ***Cutting along a contour which may be straight or irregular with a machine callednibbler***

23. What is edge forming? ***Edges of the sheet metal product are formed or folded to ensure safety inhandling and to provide stiffness to the product.***

24. Try square used in sheet metal shop is called***. Tin man's square.***

25. Hollow punch is used for ***making holes in sheets and belts.***

26. Methods of securing sheet metal joint***. Brazing, soldering, riveting.***

27. How to measure the thickness of a sheet*?* ***By using standard wire gauge or micrometer.***

28. How many mm is one inch? ***25.4 mm***

29. Increasing Gauge number means, ***reducing thickness of sheet***

30. How is a sheet metal specified? ***The material it is made of the thickness and the size of the sheet.***

31. What is shearing? ***Cutting a sheet with the help of two blades moving in opposite direction.***

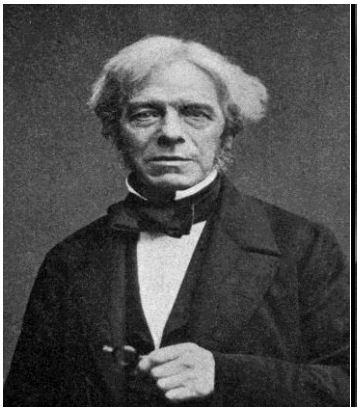
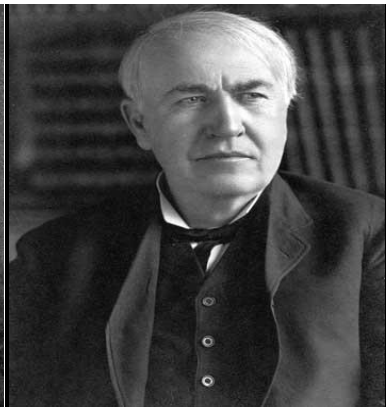
32. How to differentiate straight and cross peen hammer. ***A hammer having peen in line with handle andacross handle respectively.***

33. What is Trammel points used for? ***For drawing big arcs and circles.***

34. What happens if the sheet is worked with a hard hammer? ***Blow from a hard hammer can reduce thethickness of a sheet and it causes bulging.***

35. What type of seam is used to join bottom of a bucket? ***It is a double locked seam joint.***

E&E SHOP

MICHAEL FARADAY THOMAS ALVA ADDISON


William Bradford Shockley


John Bardeen


Walter Houser Brattain

Michael Faraday's greatest discovery in the electrical field was the principle of Electromagnetic Induction, which led to the modern Electric Motor, Generator and Transformer.

Thomas Alva Edison has been described as America's greatest inventor, holding 1,093 US patents to his name, as well as many patents in the United Kingdom, France, and Germany. His inventions in the field of electric light, power utilities, sound recording, and motion pictures help establish major new industries worldwide.

John Bardeen, William Shockley, and Walter Brattain shared the Noble Prize in Physics for their discovery of the Transistor In 1956.Transistor is considered one of the greatest inventions of the 20th century. The integrated circuits, microchips, microprocessors etc would never have existed without Transistor.

Electrical & Electronics Shop:

SAFETY PRECAUTIONS:

1. Always remember, electricity is a good servant but bad Master.
2. Always wear closed shoes with rubber sole.
3. Never touch any bare conductor in the E&E Shop.
4. Appliances should be disconnected from power supply before attempting any repair.
5. All electrical equipment should be properly earthed.
6. Never disconnect a plug by pulling it from the cord.

7. In case of fire supply should be disconnected immediately.
8. Never use water to extinguish electrical fire, CO_2 fire extinguisher or dry chemical fire extinguishershould be used.
9. In case no fire extinguisher is available sand is the best option to control electrical fires.
10. Before replacing burnt fuse, the power supply should be cut off.
11. Always ask for guidance from the shop instructor in Case of doubt.

INTRODUCTION: Undoubtedly the modern life of ours is due only to electricity. Needless to mention thatfrom a kitchen appliance to a train, it takes electricity to function. The man of today cannot imagine his life without electricity. On the other hand, nothing like mobile phones, computers, robots, missiles, rockets etc. could have been possible without the advent of electronics. The modern industry using Robots and CNC machining systems has been possible due to advances in the fields of Electrical and Electronics Engineering. **Alternating current (AC):** Is an electric current that reverses its direction at regular intervals, typically used in power supplies. Its symbol is (~) and its frequency in India is 50 Hz.

Direct current (DC): Is an electric current that does not reverse its direction at regular intervals. Its symbol is (—). Direct current is produced by sources such as batteries, thermocouples, solar cells, dynamos and Rectifiers etc. Direct current is used to charge batteries, and in nearly all electronic systems, as the power supply. Direct current is used for railway propulsion also.

Conductors: A conductor is a type of material that allows the flow of electrical current easily. For example, a copper wire is an electrical conductor that can carry electricity along its length e.g., Silver, Copper and Aluminum etc.

Insulators: An Insulator is a type of material that does not allows the flow of electrical current through it easily e.g., Ceramics, Dry Wood and Paper etc.

Semi-Conductors: Those materials which are neither good conductors nor bad conductors e.g. Silicon and Germanium.

Soldering: Soldering is an electrically conductive joining technique. It is a process of joining metal parts with the help of a low melting point metal called Solder, without their surfaces being melted.

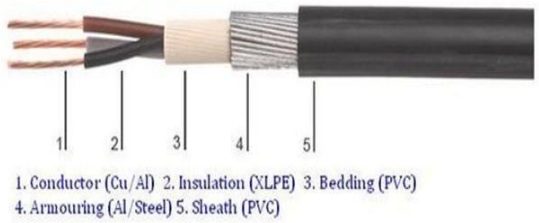
Electric Wire: It is a conductor of circular cross section which provides a passage for continuous flow of electrical current. It may be insulated or bare.

Electric Cable: An electric **cable is** an assembly of one or more electrical conductors, usually held together with an overall sheath. The assembly **is** used for transmission of electrical power

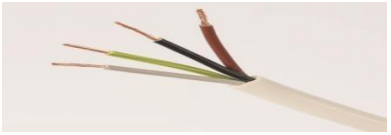
Core: In a cable consisting of a number of insulated wires each wire is called a core and has a different color.

Armoured Cable: It is a cable which carries a metallic covering over its normal insulation for safety.

Flexible Cable: It is a cable in which core consists of cluster of thin wires and provided with insulatingcovering outside.



1. Conductor (Cu/Al) 2. Insulation (XLPE) 3. Bedding (PVC)
4. Armouring (Al/Steel) 5. Sheath (PVC)



Electrical accessories:

1. **Switch:** it is a device which makes or breaks an electrical circuit. It is interposed in a phase wire**.** Thecommon types of switches are:

a) Surface or Tumbler switch: It is fitted on a mounting block or a wooden board and projects out of the surface.

b) Flush Switch: it is fitted in a Bakelite sheet and does not project outside the surface.

2. Fuse: it is a small wire, or a thin strip of a low melting point material inserted in an electrical circuit. It acts as a protection against excessive flow of current. Tin Lead, Copper etc. are the common materials used for making Fuse.

3. Ceiling Rose: Pendent Lamps, Ceiling Fans and Fluorescent Lamps are connected to installation through it.

4. Socket Outlet: it is used to provide temporary electric supply to different electrical appliances from the circuit.

5. Plugs: All the domestic appliances are connected to the sockets through their leads and plugs.

6. Lamp Holder: it holds and supports the lamp and connects the lamp to the supply terminals. Thefollowing types of lamp holders are in common use.

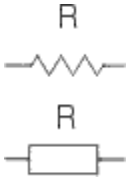
(a) Batten Holder: it is used when lamp is to be secured to the wall or roof.

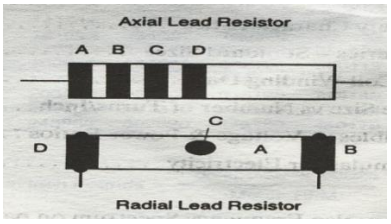
(b) Pendent Holder: it is used when the lamp is to be suspended from the ceiling Rose.

(c) Angle Holder: This type of Lamp Holder is directly secured to the wall. After fixing it remains inclined downwards.

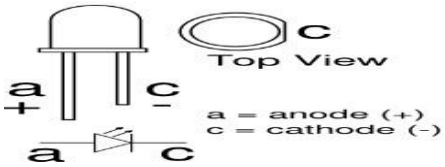
Some electronics components:

1. Resistor: Resistors are the most commonly used component in electronics and their purpose is to create specified values of current and voltage in a circuit. Two different resistors are shown in the photo. The symbol for a resistor is shown in the following diagram.



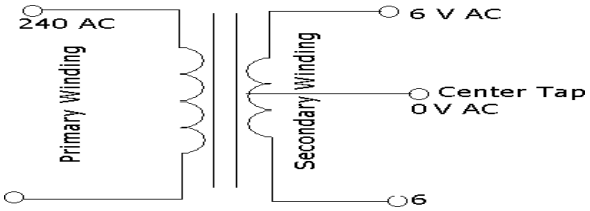


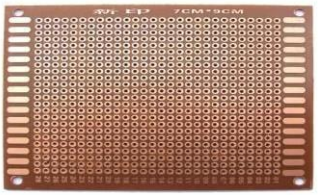
2. Capacitor: The Capacitor is a component which has the ability to store energy in the form of an electricalcharge producing a potential difference across its plates, much like a small rechargeable battery.



3. LED: Light Emitting Diodes, are heroes of the electronics world. They do dozens of different jobs and are found in all kinds of devices like digital clocks, remote controls and watches etc. Collected together, theycan form images on a jumbo television screen or illuminate a traffic light.

4. Transformer: Transformer is a static device which transforms and transfers electrical energy from onecircuit to another without any direct electrical connection. It transforms voltage without changing its frequency.





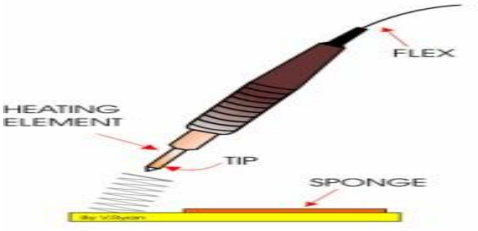
5. PCB: A Printed Circuit Board (PCB) mechanically supports and electrically connects electronic components using conductive tracks, pads and other features etched from copper sheets laminated onto a non-conductive substrate.

Tools and instruments used in E&E Shop:

Multimeter: Also known as multitester, and VOM (Volt-Ohm meter), is an electronic measuring instrumentthat combines several measurement functions like Voltage, Current, and Resistance in one unit.

Kilo Watt hour Meter: it is a device that measures the amount of electric energy consumed by a residence, business, or an electrically powered device. The consumed energy is measured in units called kilowatt hour [*kWh*].

Soldering Iron: A Soldering Iron is a hand tool used in Soldering. It supplies heat to melt the Solder so that it can flow into the joint between two work pieces.

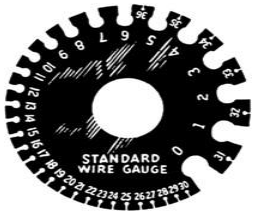


Wire Stripper: A simple manual wire stripper is a pair of opposing blades much like scissors or wire cutters. The addition of a center notch makes it easier to cut the insulation without cutting the wire.

Combination Pliers: The Combination Pliers are the pair of Pliers which can do (almost) everything. In onetool it combines the most important basic functions of pliers i.e., gripping and cutting.

Side Cutting Pliers: It is a General purpose pliers to snip light-gauge wire. Its jaws have both a gripping and a cutting section.

Long Nose Pliers: Long Nose Pliers are engineered to operate in tight spaces. A crosshatched teeth pattern provides reliable grip in either direction, while a narrow nose profile provides extra precision.



Electrical Wire Cutter Pliers: These are pliers intended for the cutting of wire and are generally not usedto grab or turn anything.

Standard Wire Gauge: Also known as **British Standard Gauge** has now been withdrawn, but is still beingused as a measure of thickness in guitar strings and some electrical wires etc.

Line Tester: It's used to check the power supply and loosening/tightening the small screws.

<u>Practical Exercise No. 3.1:</u>

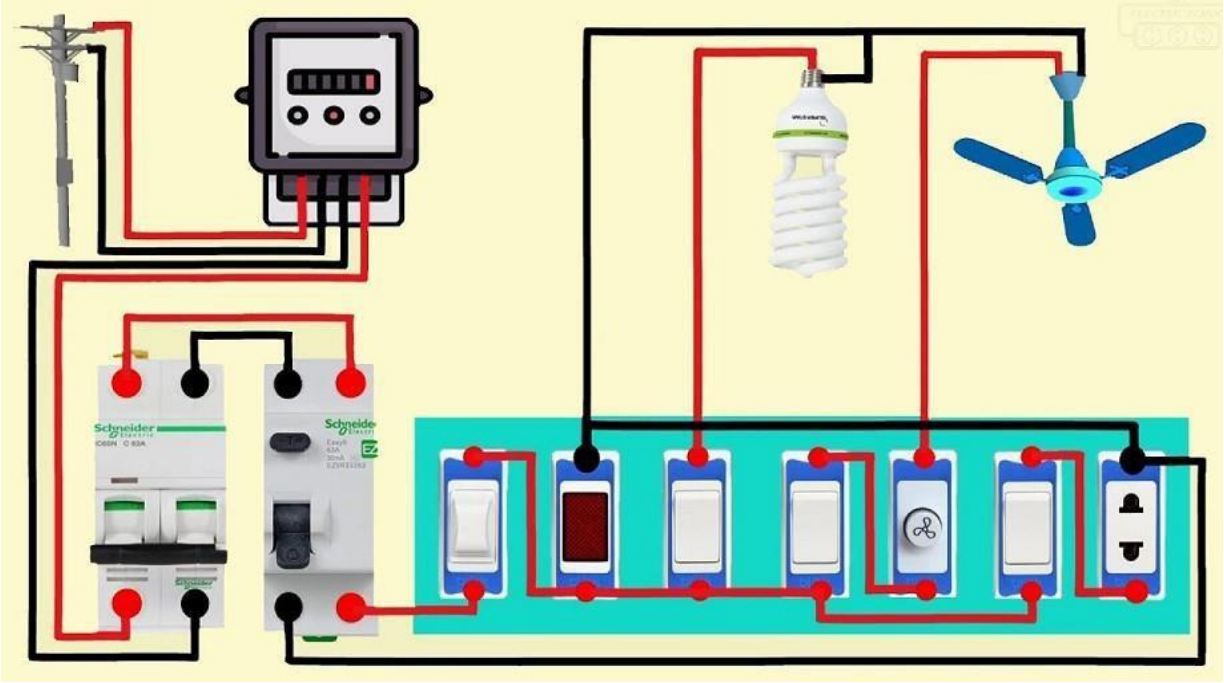
Objective: To prepare a working, house wiring circuit using different electrical accessories like energy meter, main switch, ELCB, MCB, one way switch, 3 pin plug and bulb holder etc. in Electrical & Electronics shop.

Tools Required: Neon Tester and Screwdriver Set.

Materials required: Energy meter, main switch, MCB, one way regulator, lamp holder, two pin socket, fan regulator and supply indicator etc.

Procedure:

1. All the accessories have been fixed over the practice board.
2. The students will have to make the required the required circuit as shown in the figure.
3. The red line in the figure shows the live wire, and black the neutral wire.
4. Strip wire ends properly to remove plastic completely.
5. Tighten wires correctly for secure connectivity.
6. Please show the circuit connections to the shop instructor before switching on.



Observations:

Required Parameters	Observed parameters	Measuring Instrument Used
Electrical wiring		**Line Tester**
Connectivity		**Series Lamp, Test lamp**
Bulb Glows		**Visual check**

Practical Exercise No. 3.2:

Objective: To make a Center-Tap Full-Wave Rectifier.

Tools Required: Soldering Iron 25w, Solder Wire, Soldering Flux, Neon Tester and Screwdriver Set and Twizzer.

Items required: Transformer 6-0-6 V, Diode In 4007, Transistor 7805, Resistance 1kΩ, Capictor1000µF, LED 3V, Printed Circuit Board 5x3 cm and Jumper Wire.

Theory: In full-wave rectification, when AC supply is applied at the input, during both the half cycles (i.e., positive as well as negative) current flows through the load in the same direction. This can be achieved by using at least two crystal diodes, conducting current alternatively.

A transformer with secondary winding AB tapped at the center point C. The two diodes D1 and D2 are connected in the circuit so that each one of them uses one half cycle of input AC voltage. The diode D1 utilizes the AC voltage appearing across the upper half (AC) of secondary winding for rectification while D2user the lower half (CB) of secondary winding.

Operation: When AC supply is switched on, the alternating voltage (V) appears across the terminals AB of secondary winding of transformer. During positive half-cycle at secondary voltage, the end A become positive and end B negative. This make the diode D1 forward biased and diode D2 reverse biased. Therefore, diode D1 conducts while diode D2 does not. Thus, current (i) flows through diode D1, load resistor Rl and the upper half of secondary bold arrowhead. During negative half cycle, the end B becomes positive and end A becomes negative. This makes diode D2 forward biased and diode D1 reverse biased. Therefore, diode D2 conducts while diode D1 does not. Thus current (i) flows through diodeD2, load resistor RL and the lower half of the secondary winding. It may be seen that the current flows through the load resistor RL in the same direction (i.e., from M to L) during positive as well as negative half of input ACvoltage. Therefore, DC output is obtained across the load resistor RL.

Procedure:

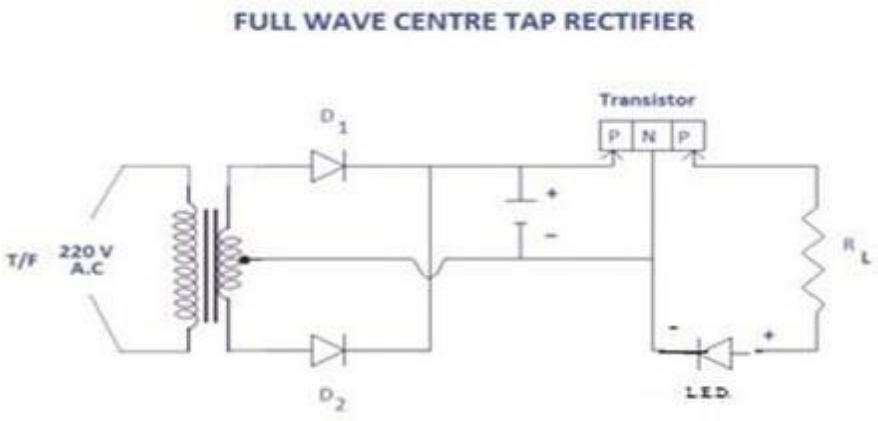
1. Take PCB and all components required; then install components as per the circuit diagram.

2. Solder the components by Soldering Iron and check the circuit continuity by Multimeter.
3. Install LED then Solder it and connect the assembly to the 220v supply.
4. LED glow indicates the output of Direct current, and our job is successfully completed.

Precautions:

1. Clean components before Soldering.
2. Solder carefully to avoid dry Soldering.

Practical Exercise No. 3.2:



Observations:

Required Parameter	Actual Parameter	Measuring Instrument Used
A/C Voltage (220/240 V)		A/C Voltmeter
D/C Voltage (6 to 12 Volt V)		D/c Voltmeter
Component Capacity Test Electronic components (Txr, D1 D2, C1, PNP, R/L LED)		Multimeter
Electrical wiring	Good/ Bad	Line Tester
Connectivity	OK/ Not Ok	Series Lamp, Test lamp
Bulb Glow	Y/N	

Sample Viva questions with answers for electrical & electronics shop:

1. What is electric current/electricity? ***Flow of electrons through a conducting material***

2. What is a conductor? ***Material which allows the current to flow through it easily.***

3. List some good conductors. ***Silver, Copper, Aluminum etc.***

4. What is insulator? ***Material which does not allows the current to flow through it.***

5. What is a semiconductor? ***Materials having electrical conductivity between that of a conductor and an insulator.***

6. What is a superconductor? ***It is a material that can conduct electricity with no resistance.***

7. At what temperature a material becomes super conductor? ***At absolute zero.***

8. What are piezoelectric materials? ***Piezoelectric materials are those that produce an electric current when theyare placed under mechanical stress.***

9. What are the uses of piezoelectric materials? ***These materials are used in various sensors, audible alarms,speakers, telephones, guidance systems, and sonars etc***.

10. What are the most commercially important semi-conductor materials? ***Silicon and Germanium.***

11. How important are the semi-conductors? ***Semiconductors are the foundation of modern electronics, including Transistors, Solar Cells, Light-Emitting Diodes (LEDs), Quantum Dots and Digital and Analog Integrated Circuits.***

12. What are the distinct properties of semi-conductors? ***Semiconductors can display a range of useful properties such as passing current more easily in one direction than the other, variable resistance, and sensitivity to light or heat.***

13. What is a transformer? ***A safe and efficient voltage converter to change the AC voltage at its input to a higher orlower voltage at its output.***

14. What is the principle of working of a transformer? ***Transfer of energy between two circuits through electromagnetic induction.***

15. Why is Magnetic Core used in a Transformer? ***The use of a Magnetic Core can enormously concentrate the strength and increase the effect of magnetic field.***

16. What is Material of the Core? ***Silicon Steel.***

17. What are Instrument transformers? ***Current transformers, together with voltage transformers (VTs), which are designed for measurement, are known as instrument transformers.***

18. What is Silicon Steel, ***also called Electrical steel, lamination steel, silicon electrical steel, relay steel or transformer steel is special steel tailored to produce small hysteresis loss and high permeability.***

19. What is function of a fuse in electrical circuit? ***Is a type of low resistance resistor which melts under flow ofheavy current due to short circuit or overloading to break the circuit?***

20. What is a circuit breaker***? an automatically operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit. Unlike a fuse, which operates once and then must be replaced, a circuit breaker can be reset to resume normal operation***.

21. What is meant by one unit of electricity? ***1KWh***

22. What is meant by Green Energy? ***Energy produced from non-polluting and renewable sources like solar, hydro, wind and geothermal etc.***

23. Name the components used in a Centre Tap Full Wave Rectifier? ***Transformer, LED, Capacitor, Resistor.***

24. Units of Capacitance? ***farad***

25. What is color coding in 3 phase power supply? ***RYBB.***

26. Explain the difference between earth and neutral: ***Neutral is a part of the electrical circuit whereas earth is not***

27. Who is known as the father of electricity? ***Michal Faraday***

28. Who invented Transistor? ***John Bardeen, Walter Houser Brattain, and William Bradford Shockley.***

29. Material of Filament in incandescent lamp. ***Tungsten***

30. What is a Fluorescent Lamp? ***An electric current in the gas excites mercury vapor which produces short-wave ultraviolet light causing a phosphor coating on the inside of the lamp to glow.***

31. What is Inverter? ***Inverter is an electronic device or circuitry that changes direct current (DC) to alternatingcurrent (AC).***

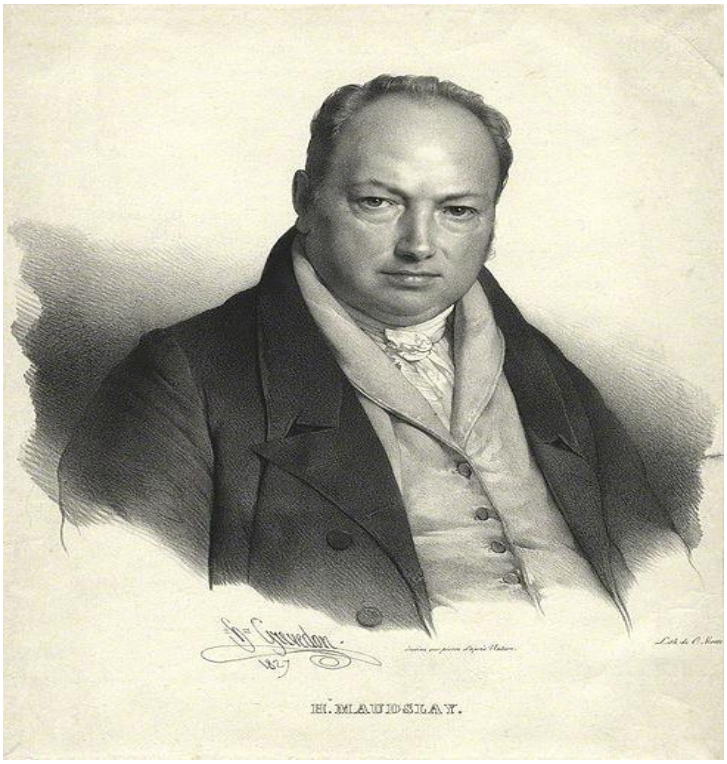
32. What is a Rectifier? ***An electrical device which converts an alternating current into a direct one by allowing acurrent to flow through it in one direction only.***

33. What is Diode? ***A semiconductor device with two terminals, typically allowing the flow of current in onedirection only.***

34. Name some types of diodes***: Zener diode, Tunnel diode, Laser diode and photodiode etc.***

35. Why is mica sheet used in electric Iron? ***Because it allows heat to pass and stop current from flowing to metallicbase.***

MACHINE SHOP



Henry Maudslay

- Henry Maudslay developed the first industrially practical screw-cutting lathe in 1800.
- He pioneered the idea of standardization of screw thread sizes for the first time.
- He also produced sets of Taps and Dies that would make nuts and bolts consistently to those standards.
- He also invented the first bench micrometer capable of measuring to one ten-thousandth of an inch(0.0001 in ≈ 3 μm)

SAFETY PRECAUTIONS:

1. Machine shop has powered rotating machines like Centre Lathe. Take extreme care to ensure thatanything which could get entangled in rotating parts is kept away.
2. Always wear lab coat in the Turning shop, loose clothing could be a serious safety hazard for chances ofits entanglement in rotating parts.
3. Wearing neckties, bangles, bracelets, watches etc. while working on lathes could also be hazardous due tothe risk of their getting caught in lathe chuck
4. Long loose hair have history of causing fatal accidents on lathes.
5. Wear closed shoes with rubber sole, hot chips can cause burns.
6. Never operate any Machine unless you know how to operate it.
7. Never touch moving parts like Chuck, Belt or rotating grinding wheels etc.
8. Stay clear of the starting switch on the lathe. Accidental pressing of the switch may cause fatal accident.
9. In case of risky or dangerous situation immediately cut off power supply by pressing red button on thestarter.
10. Always stay careful while working on powered machines like lathes etc.

Metal Cutting/Machining: Metal Cutting or "Machining is the process, by which parts are produced by removing unwanted material from a block of metal in the forms of chips. This process is the most important as almost all the products get their final shape and size by machining.

Machine Shop: Parts having been formed to preliminary shapes by Casting or Forging etc. are finished to final shape & Size by machines called Machine Tools. The workshop where these Machine Tools are used for carrying out finishing operations on the parts is called the "Machine Shop."

Turning Shop: Machine Shop with only one type of Machine tools i.e., a Centre Lathe is used for manufacturing and finishing parts is called 'Turning Shop'. In any manufacturing activity the role of the Lathe is indispensable.

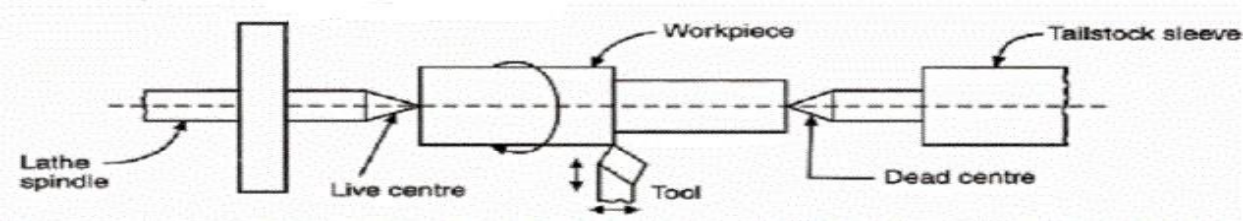
Machine Tool: - Machine tool is a powered device which performs material removal operation on the work piece to give desired shape and size to the work piece. Machine tool performs the following four main functions: It

1. Holds the work piece.
2. Holds the cutting tools.
3. Moves one or both of these.
4. Provides feeding motion to one of them.

Examples of Machine Tools: 1. Centre /Engine lathe. 2. Shaper / Shaping Machine. 3. Drilling Machine. 4. Planer / planing Machine. 5.Power Hacksaw. 6. Milling Machine. 7. Cylindrical Grinder etc.

Centre Lathe. It is so called because it has two Centres between which the work piece can be held and rotated. It is also called "Engine Lathe" because firstly this type of lathe was driven by a steam engine. Its main objective is to remove material by rotating the work piece against the cutting tool. It may also be used for many other purposes such as Threading, Drilling Reaming, Boring, Grinding and Milling etc.

Working principle of Lathe. In this Machine Tool work piece is held in a chuck or between the Centres and rotated about its axis at a uniform speed. Cutting tool is held in the Tool Post and is fed into the work piece in the desired direction i.e., in linear, transverse, or lateral.



Types of lathes: Though the fundamental principle of operation of all lathes is same yet they are classified accordingly to design, type of drive, arrangement of gears, and the purpose of use etc, following are the important types of lathes: 1. Speed lathe 2. Engine / Center lathe 3. Bench lathe 4. Tool Room lathe

5. Capstan & Turret lathe 6. Automatic lathe 7. Special purpose lathe etc.

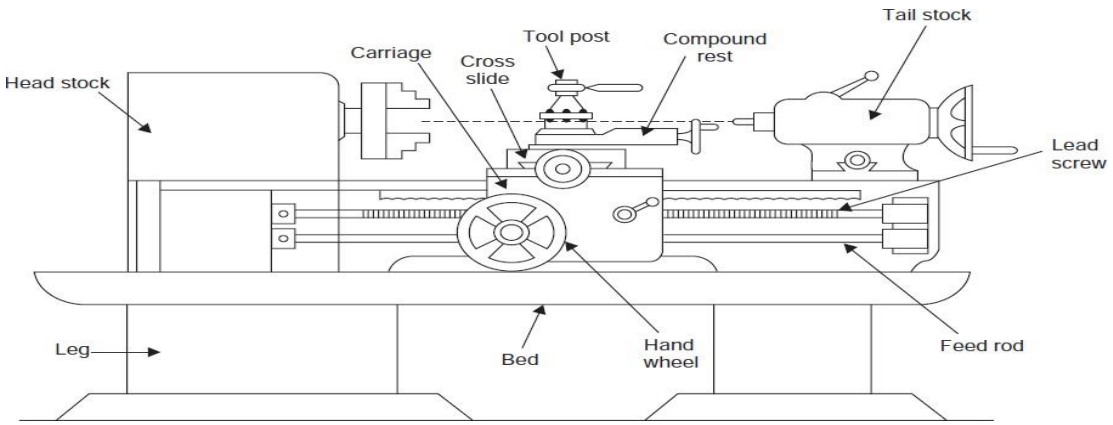


Fig: Block diagram of a Centre Lathe

The Main parts of lathe.

1. Bed - The Bed is the base or foundation of the lathe. It is a massive and rigid casting made in one pieceto resist deflection and vibrations. It supports or holds all other parts of the lathe.

2. Head Stock- It supports the main spindle in the bearings and aligns it properly and provides different spindle speeds. Holding devices like Three Jaw Chuck, Four Jaw Chuck and Faceplate etc, are mounted on Head Stock spindle.

3. Tail Stock - It is movable part located opposite to Head Stock on the Bed ways. It is used for two purposes. (a) To support free end of the long jobs during machining. (b) To hold certain cutting tools for performing operations like drilling, reaming & tapping etc.

4. Carriage-It is located between Headstock and Tailstock. It can slide along Bed ways and can be located at any position by tightening the Carriage lock screw. It consists of following five main parts. (a)Tool post

(b) Compound Rest (c) Cross Slide (d) Saddle (e) Apron

5. Feed mechanism-provides feed motion to the cutting tool and consists of (a) Feed Gear Box (b) Feed Shaft(c) Feed Selectors etc.

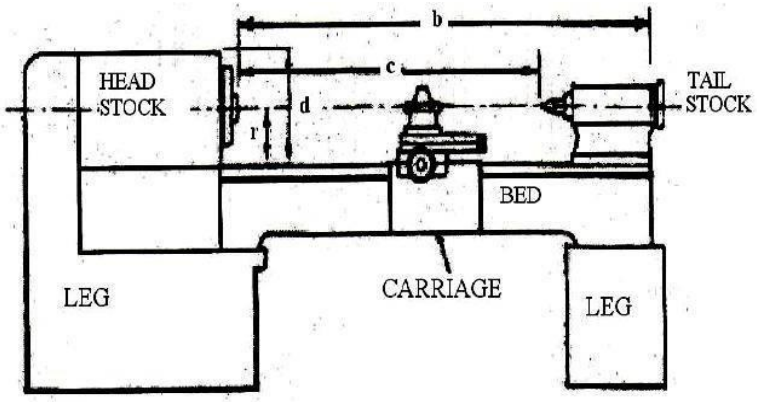
Specifications of lathe- The size of the lathe is specified as below:

b: Length of Bed.

c: Admittance b/w centers i.e., Maximum Job length that can be admitted b/w live & dead center.

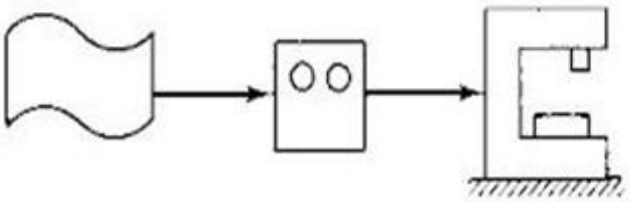
d: Swing over Bed i.e., Maximum diameter of the work piece that can be rotated over Bed.

r: Centre height.



Numerical control (NC) of Machine Tools: It is the automation of machine tools that are operated by precisely programmed commands encoded on a storage medium, as opposed to manual control. Most NC today is **computer numerical control** (**CNC**), in which computers play an integral part of the control.

History of Numerical control (NC) John T Parson is regarded as the Father of Numerical Control. His brilliant conceptualization of NC marked the beginning of an age in which the control of machines and industrial processes would pass from imprecise craft to exact science. His team built a first NC machine tool at University of Michigan in 1952

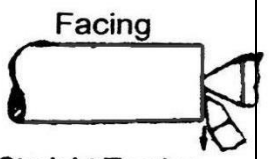


Program of Instructions **Control Unit** **Machine Tool**

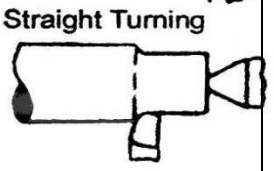
Fig: Three Basic Component of Numerical Control System

Operations performed on Lathe:

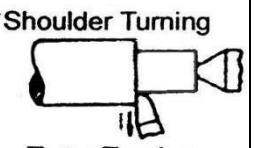
Facing: In the context of Turning work, it involves moving the cutting tool at right angleto the axis of rotation of the rotating work piece. This can be performed by the operation of the cross-slide.



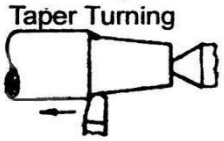
Straight Turning: It is one of the most basic machining operations. That is, the part is rotated while a single point cutting tool is moved parallel to the axisrotation.



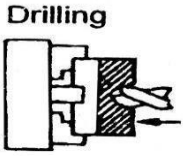
Shoulder turning: In Shoulder turning, there is a 90-degree face moving fromone diameter to the other as you can see in the fig. It is done by moving Cutting tool at Rt angle to the job axis using cross slide.



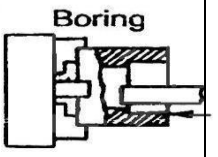
Taper Turning: Machining a cone or frustum of a cone by turning at an Angle to thejob axis.



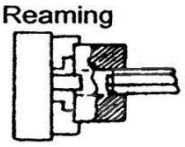
Drilling: is used to remove material from the inside of a work piece. This process utilizes standard drill bits held stationary in the tail stock of the lathe.



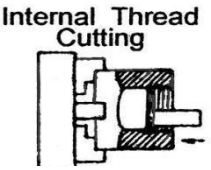
Boring : Enlarging or smoothing an existing hole created by drilling, mouldingetc. by using a cutting tool mounted in a Boring bar.



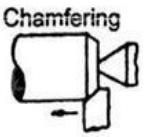
Reaming: The sizing operation that removes a small amount of metal froma hole already drilled. It is done for making internal holes of very accurate diameters.



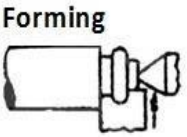
Threading : Both standard and non-standard screw threads can be turnedon a lathe using an appropriate cutting tool. (Usually having a 60, or 55° nose angle) either externally, or within a bore.



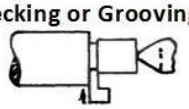
Chamfering: Chamfering connects two surfaces with a beveled edge. If the surfaces are at right angles, the chamfer will typically be symmetrical at 45 degrees. A form tool is used for chamfering.



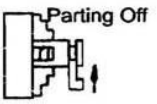
Forming: The forming is an operation that produces a convex, concave or any irregular profile on the work piece, using a form tool having a form cut in opposite direction.



Grooving: Grooving is like parting, except that grooves are cut to a specific depth, instead of severing a completed / part-complete component from the stock.



Parting Off: This operation is also called **cut off.** It is used to create deep grooves which will remove a completed or part-complete component from its parent stock.



Lathe tool materials: The tool used in a lathe for general purpose work is a single point cutting tool. The material used for lathe tools should have hardness, toughness, heat resistance and low wear. The commonly used cutting tool materials are High Speed Steel, Cemented Carbides, Cubic Boron Nitride (CBN), Diamondand Ceramics etc.

Practical Exercise No. 3.3(a):

Objective: To make a job, involving Facing, Plain turning, Step turning & chamfering etc.

Equipment & tools required: Center Lathe, Turning Tool, Grooving Tool, Steel Rule & Vernier Caliper etc.

Material: Mild Steel bar **Ø** 25 x 125 mm.

1. Hold the bar in 3 jaw chuck in a way that at least 20 mm of bar stock is projected outside the chuck.
2. Do facing of both the ends of bar and maintain dimn.120 mm.
3. Hold the turning tool in Tool post so that it projects out of the tool post about 25 mm. The cutting edgeof the tool should coincide with the center of work piece.
4. Hold the job in a 3 jaw chuck, about 45 mm of the job projecting out. The **Ø** 22 mm is obtained firsttaking one or more rough cuts then finally a finishing cut of not more than 0.50 mm depth is taken.
5. Similarly turn **Ø** 18 mm to a length of 30 mm from the free end.
6. Champher the free end.
7. Remove job from the Chuck and hold from **Ø** 18 mm resting against **Ø** 22 mm shoulder.
8. Reduce and finish **Ø** 25 mm to **Ø** 21 mm up to length 78 mm from end by plain turning.
9. Turn **Ø** 18 mm up to length 30mm as explained above.
10. Do Champhering on the free end at the same setting.
11. De burr all over and remove job from the Chuck.

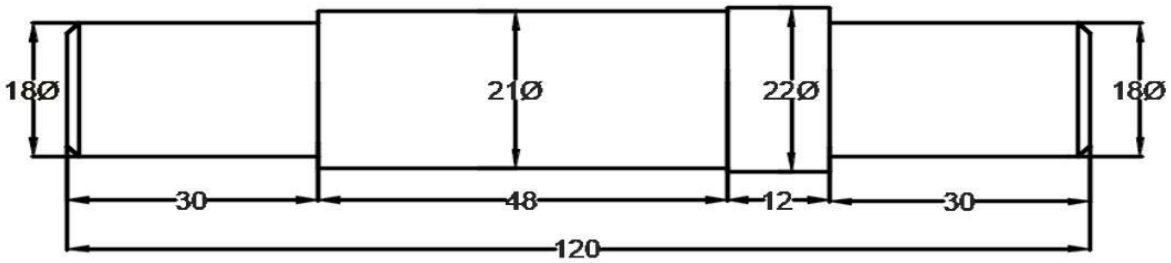


Fig. 3.3(a): All Dimensions are in mm (Tolerance ± 0.5mm on lengths; ± 0.1mm on diameters)

Observations:

Designed Dimensions	Actual Dimensions	Measuring Instrument Used
Ø 18, 18 mm		**Vernier Caliper**
Ø 22 mm		**Vernier Caliper**
Ø 21 mm		**Vernier Caliper**
Length 120 mm		**Vernier Caliper**
Length 30 mm		**Vernier Caliper**
Length 12 mm		**Vernier Caliper**
Length 48 mm		**Vernier Caliper**
Length 30 mm		**Vernier Caliper**

Practical Exercise No. 3.3(b):

Objective: To make a job, involving operations, Facing, Plain Turning, Step turning Grooving, Taper turning, Knurling and Chamfering etc.

Equipment & Tool Required: Center Lathe, Turning Tool, Grooving Tool, Steel Rule, Vernier Caliper etc.

Material: Job made in previous practical

Procedure:

1. Hold the job from **Ø** 21 mm and about 60 mm length projected outside the chuck.
2. Turn **Ø** 22 to **Ø** 21 and turn a groove of 8 mm width and **Ø** 17 using a parting tool.
3. Do diamond knurling on **Ø** 21.
4. Champher the free end.
5. Remove job from the chuck and hold from **Ø** 18 resting against the step **Ø** 22.
6. Turn **Ø** 21 mm to **Ø** 19 mm throughout length.
7. Find the half taper angle using the relation Tan θ = D-d/2L= 19-16/2x40=.0375, θ = 2.15°
8. Set the Compound slide at the calculated angle.
9. Turn taper slowly till a regular taper connecting **Ø** 16 to **Ø** 19 mm is achieved.
10. Champher the free end.
11. Deburr all over.
12. Remove job from the chuck and inspect.

Practical Exercise No. 3.3(b):

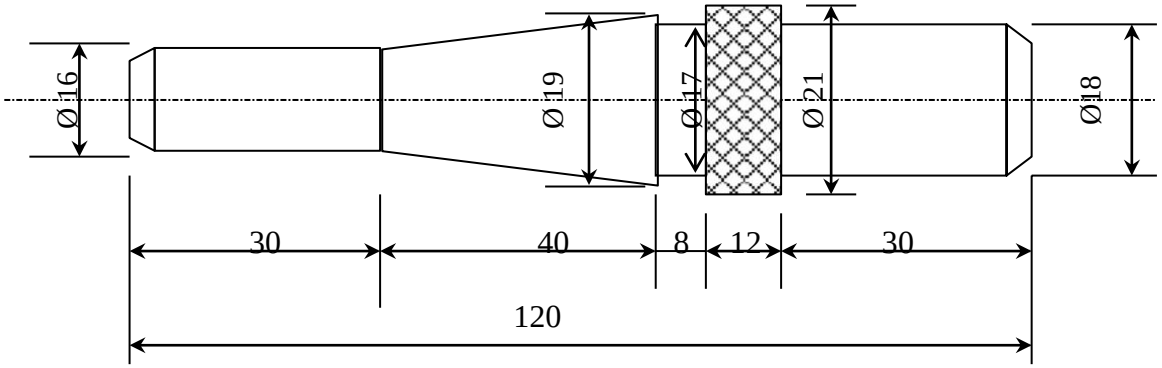


Fig. 3.3(b): All Dimensions are in mm (Tolerance ± 0.5mm on lengths; ± 0.1mm on diameters)

Observations:

Designed Dimensions	Actual Dimensions	Measuring Instrument Used
Ø 16 mm		**Vernier Caliper**
Ø 19 mm		**Vernier Caliper**
Ø 17 mm		**Vernier Caliper**
Ø 21 mm		**Vernier Caliper**
Ø 18 mm		**Vernier Caliper**
Length 30 mm		**Vernier Caliper**
Length 12 mm		**Vernier Caliper**
Length 8 mm		**Vernier Caliper**
Length 40 mm		**Vernier Caliper**
Length 30 mm		**Vernier Caliper**

Sample Viva questions with answer for Machine Shop

1. What are the important safety precautions to be observed in a Machine Shop?

2. What is a Machine? ***It is a device that uses energy in some available form, and converts this energy into useful form ofwork. Ex. Bicycle, Sewing Machine and hydraulic press etc.***

3. What is a Machine Tool? ***A powered device which performs material removal operation, with the help of cutting toolsto give desired shape and size to the w/p.***

4. Name some Machine Tools: ***Centre Lathe, Shaper, Drilling machine, Power Hacksaw, grinding machine and boringmachine etc.***

5. What are different types of Lathes? ***Speed lathe, Bench lathe, Tool Room lathe, Centre Lathe, Copying lathe, CNClathe, Turret lathe and Capstan lath etc.***

6. Who invented the first ever screw cutting lathe? ***Henry Maudslay in1800.***

7. What is the principle of working of lathe? ***A job is held between Centres and turned on its axis. A cutting tool is brought in contact with the W/P and the metal is removed in the form of chips. Hardness of the cutting tool must at least be 1.5 times the hardness of the W/P.***

8. List some of the operations that can be done on the Centre Lathe. ***Plain Turning, Parting Off, Grooving, Threading, Knurling, Drilling, Chamfering and Necking etc***

9. Name the five main parts of a Lathe***. Bed, Head Stock, Tail Stock, Carriage and Feed Mechanism.***

10. Why is Lathe bed commonly made of Cast Iron? ***Due to the following reasons (i) It can be cast in a single piece for strength and rigidity (ii) CI has self-lubricating properties due to free graphite in it (iii) CI has noise and vibration damping properties.***

11. Why is Centre Lathe so called? ***Since it has two Centres called Live and Dead Centre.***

12. Why centre lathe is also called Engine Lathe? ***Because it used to be run by steam or diesel engine before the adventof Electric motor.***

13. Name the five main parts of a Carriage? ***Tool post, Compound Slide, Cross Slide, Saddle and Apron.***

14. What is 'live' and 'dead Centre' in regards to Centre lathe? ***Live Centre is a powered Centre located in Head Stock spindle and Dead Centre is without power located in Tail Stock.***

15. What is the use of Lead screw on a Centre lathe? ***It gives motion to the Carriage during Threading operation.***

16. What are the different holding devices used On Lathe? ***3 Jaw Chuck, 4 Jaw Chuck, Face Plate, Collet Chuck andPneumatic Chuck etc.***

17. Name some Lathe accessories. ***3 Jaw Chuck, 4 Jaw Chuck, Face Plate, Collet Chuck, Pneumatic Chuck, SteadyRest, Follower Rest, Mandrel, Angle Plate ,Dead Centre, Lathe Dog and Revolving Centre etc***.

18. What is the difference between 3jaw and 4 jaw Chuck? ***3 Jaw Chuck also called Self Centering Chuck, is used forholding symmetrical jobs. 4 Jaw Chuck also called independent Chuck, is used for holding Asymmetrical jobs.***

19. Explain the use of a Face Plate***. Jobs which can't be held in chucks due their shape are held in Face plate.***

20. Where do we use a Collet Chuck? ***It is used for holding cylindrical jobs in production lathes.***

21. What is the use of Rests? ***Rests are used to support long jobs.***

22. What is the difference between a Steady Rest and a Follower Rest? ***Steady Rest does not move and is fixed to the Lathe Bed. It is used when operation is to be done on the end of a job. Follower Rest moves is fixed on Carriage and moves with it. It is used to support long slender jobs while turning.***

23. Name some Cutting tool materials used for Lathe tools? ***High Speed Steel (HSS), Tungsten Carbide (WC), Ceramics, Cubic Boron Nitride (CBN) and Diamond etc.***

24. What is CBN? ***The second hardest material after diamond is a heat and chemically resistant refractory compound ofboron and nitrogen.***

25. What is a refractory material? ***Material which can retain its hardness at very high temperatures.***

26. Which is the most common cutting tool material in use these days? ***It is Cubic Boron Nitride (CBN)***

27. Why can't be use HSS tool for machining hard metals? ***Because it cannot retain its hardness at elevated temperature.***

28. What are the major Lathe specifications? ***Admittance between Centres (ABC), Height of Centres (HOC), Swing, No. of Spindle speeds, range of feeds and thread pitches.***

29. What is the least count of a Vernier Caliper? ***It is 0.02mm.***

30. Who invented the Vernier Scale? **Pierre Vernier** ***a French mathematician in 1631.***

31. What is the least count of a Micrometer? ***It is 0.01mm.***

32. What is the use of a Dial Indicator? ***It is used to show the total indicated run out (TIR) of the W/P***

33. Name the principal parameters of machining***. Cutting velocity, feed and depth of cut.***

34. What is a Turret Lathe? ***A sturdy Lathe used in mass production, capable of working with no. of cutting tools at atime.***

35. Why you must be very careful while working on Lathe? ***Since Lathe is a powered Machine Tool and has partsrotating at high rpm. Risk of getting loose clothes and hair entangled in rotating parts is very real.***