Lab Manual

for

WORKSHOP-III

4^{th} Semester, Mechanical Engg.

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General Safety Precautions in Workshop

Why do you think workshop Safety Rules are important?

If everyone follows workshop rules, everyone will be safe and learn how to use tools and equipment properly and efficiently.

1. Always listen carefully to the teacher and follow instructions.

The instructions given by your teacher, his / her demonstrations on the use of equipment and tools, will help you understand how to work in a workshop safely and efficiently.

2. Do not run / rush in the workshop.

You could 'bump' into another pupil and cause an accident. You could run into a machine or bench, which could cause a serious injury.

3. Know where the emergency stop buttons are positioned in the workshop.

If you see an accident at the other side of the workshop, you can use the emergency stop button to turn off all electrical power to the machines.

4. Always wear an apron.

It will protect your clothes and hold loose clothing such as ties in place. This will prevent loose clothing getting caught in a machine, pulling the machine operator into the moving parts.

5. Wear good strong shoes. Training shoes are not suitable.

Tools and equipment can have sharp edges and are usually heavy. Good shoes prevent damage to feet, if a piece of equipment or a tool, is dropped on feet.

6. When attempting practical work, all stools should be put away.

If stools are left out in the workshop during a practical session, they will get in the way and inevitably become a trip danger.

7. Bags should be stored away, during practical sessions in the workshop.

A person can easily trip over a bag left on the floor and accidentally push into someone using a machine. This could cause a serious accident.

8. When learning how to use a machine, listen very carefully to all the instructions given by the teacher. Ask questions, especially if you do not fully understand.

It is very important to ask questions, especially when learning how to use machines and tools, if there is a need to clarify instructions. Using a machine without a full understanding of its use, could easily lead to an accident.

9. Do not use a machine, if you have not been shown how to operate it safely, by your teacher.

It is extremely dangerous (and illegal), to use a machine in the workshop, without having followed and understood, all the teacher instructions.

10. Always be patient, never rush practical work.

The most productive and efficient 'craftspeople / engineers', work patiently and never rush their work. Working at a safe, steady pace, is how skilled professions complete their tasks.

11. Always use guards, when operating machines.

The guard on a machine, protects the user, especially the users eyes, from dangerous ‘debris’ that is thrown out, often at high speed. The guards also ensure that hands and fingers, are not near moving parts. A good example of a machine guard, is seen in front of the chuck, of a machine drill.

12. Keep hands / hair and clothing away from moving/rotating parts of machinery.

Loose Clothing (e.g. a school tie) and long hair, can be caught in the moving parts of a machine (e.g. the chuck of a drill). Hands / clothing should must be kept away, from the moving / rotating parts. Long hair should be tied back.

13. Use hand tools carefully, keeping both hands behind the cutting edge.

Never place a hand in front of a cutting tool (e.g. a chisel). There is always a possibility, of the tool slipping and the sharp edge slicing into the hand / fingers.

14. Report any damage / faults to machines/equipment. Damage or a faulty part, could cause an accident.

A broken or damaged tool can be dangerous. For example, a hammer with a loose hammer head ,should be reported to the teacher. It is always possible that the hammer head will ‘fly off’ the handle, when it is in use.

15. Keep your workbench tidy. When you have finished with a tool / piece of equipment, return it to its storage cupboard / rack.

A bench top, crowded with tools, will eventually lead to one or more, being knocked on to the floor, or on to feet. Tools are damaged easily and people can be injured.

16. Never distract another pupil, when they are working on a machine or using tools / equipment.

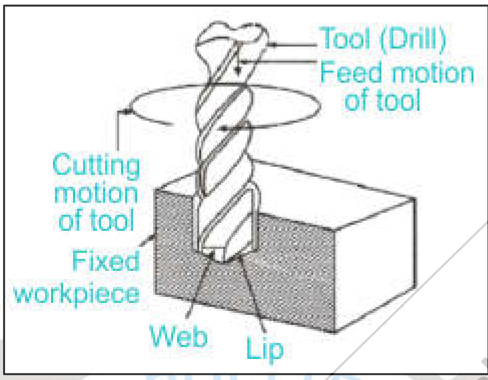
A distracted pupil could have an accident, as a distraction will take their focus and concentration away from the work they are doing. If using a tool / machine, a distraction can easily lead to an accident.

Drilling

- Drilling is a machining process that involves using a drill bit to cut a hole into a material.
- It is the process of creating a cylindrical hole of the specified diameter and depth by removing metal with the rotating edges of a drill.

Working Principle of Drilling Machines

- When power is supplied to the motor, the spindle rotates, causing the attached stepped pulley to also rotate.



- On the opposite end, a stepped pulley is attached, which can be inverted to increase or decrease the rotational speed.
- A V-belt is installed between the stepped pulleys for maximum power transmission.
- Now, the drill bit that was placed in the fixed workpiece is connected to the spindle.
- As it rotates through the rotation of pulleys, the drill bit rotates. The spindle is moved down to advance the drilling process with the help of a handwheel.
- After the hole is drilled, the handwheel is rotated to lift the spindle.
- The final result creates a hole in the fixed workpiece.

Parts of Drilling Machine

Base

The whole machine is mounted and supported by the base.

Column

- It is also called a pillar and is typically a hollow, cylindrical component the joins the base, table, and head.
- Moreover, the column functions as a linear slide on which the table is raised and lowered.

Spindle

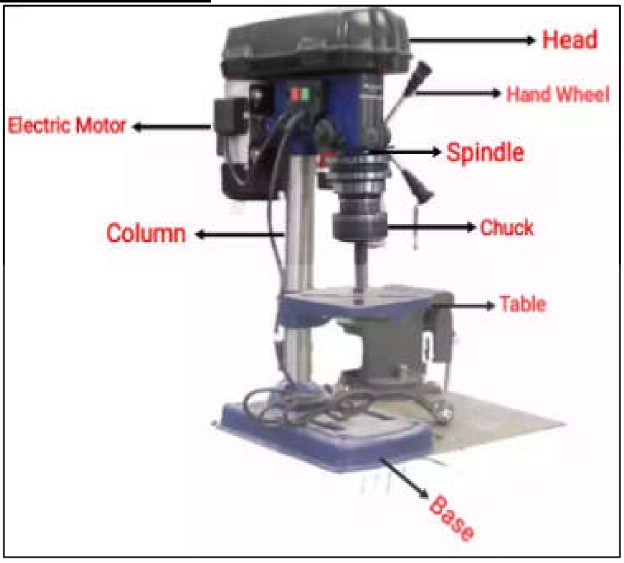
- The spindle is a shaft assembly with bearings which joins the electric motor to the chuck.
- They transmit the rotational motion of the drill head. With the aid of the rack and pinion system, it can move up and down.

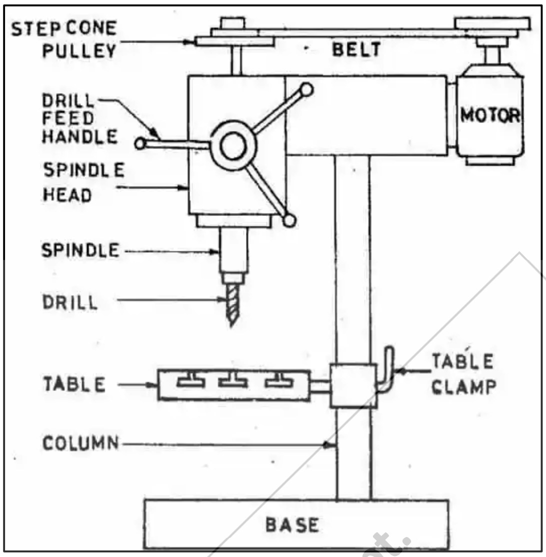
Chuck

- During drilling operations, the chuck is used to hold the tool tightly to prevent it from slipping.
- Typically, a drill chuck has three adjustable jaws to accommodate various drill bit diameters.

Table

- The table provides the workpiece with a stable surface.
- Moreover, the table has T-slots or holes to allow workpiece clamping.
- They may be circular or rectangular.





Head

The spindle, the feed mechanism, and the drill chuck are all housed within the drill head.

Electric Motor

The electric motor can either directly drive the spindle through the use of a gearbox or indirectly through the use of a series of belts and pulleys.

Drilling Machine Tools

Flat or Spade Drill

When a twist drill is not available, a flat drill is used.

Flat Drill Bit

Straight Fluted Drill Bit

Straight Fluted Drill Tool

Straight-fluted drills have flutes or grooves that are perpendicular to the drill axis, mostly used to drill brass, copper, or other softer materials.

Twist Drill Tool

- It was created by longitudinally twisting a flat piece of tool steel multiple times and then honing the surface.
- There are four major classifications of a twist drill: Parallel shank, parallel stub shank, parallel long shank, and taper shank.

Taper Shank Core Drill

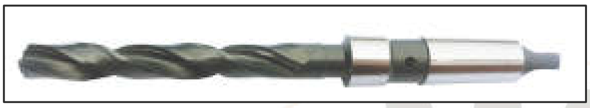
- These drills are made to enlarge holes that have already been punched, drilled, or cored.
- The cutting edges are machined well below the centre of the drill.

Twist Drill Tool

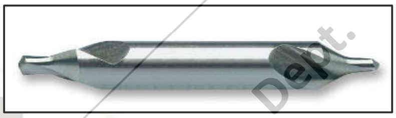
Taper Shank Core Drill Bit

Oil Tube Drill

The process where oil tubes are bored through the earth's surface using an earth drilling machine to form an oil well is called oil drilling.



Centre Drill Bit



Oil Tube Drill Bit

Centre Drill

When drilling centre holes into the ends of a workpiece, these twist drills with a straight shank and two flutes are the tools that are employed.

Other Operations on a Drilling Machine

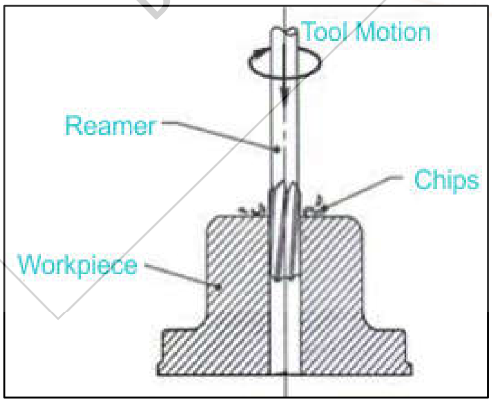
The following is a list of various drilling machine operations to create different types of holes.

Reaming

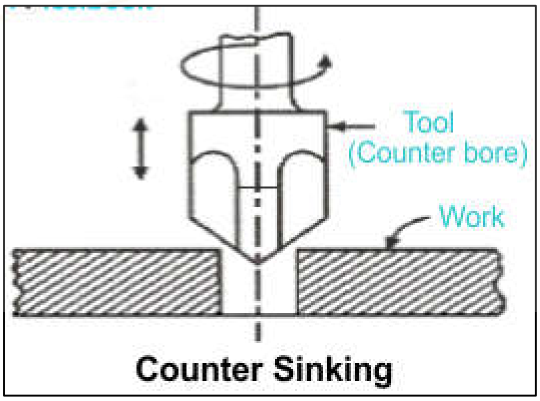
- A high-precision hole-finishing procedure carried out with a multi-edge tool is known as reaming.
- High penetration rates and shallow cuts involved in the reaming process enable close dimensional tolerance, excellent hole quality, and a high surface finish of the previously drilled hole in the workpiece.

Countersinking

- The process of enlarging one end of the hole giving it a conical shape is called countersinking.
- It is frequently employed for deburring drilled or tapped holes, and to ensure fasteners sit tightly in the holes.



Schematic of Reaming Operation



Schematic of Countersinking Operation

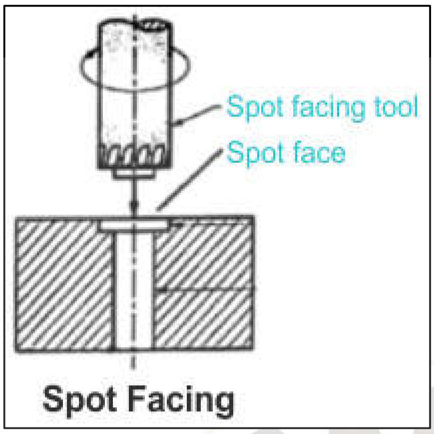
Spot facing

- A technique used to create a flat edge on a cylindrical workpiece is called spot facing.

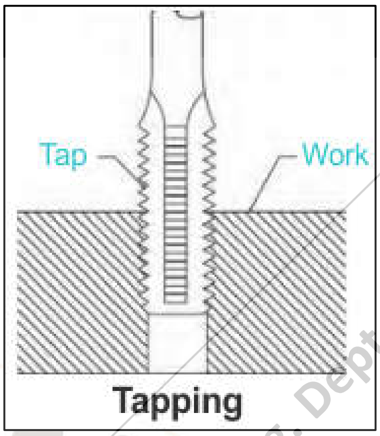
- This operation involves smoothing and squaring the top surface of the hole for a nut or screw head seat.

Tapping

- The process of creating internal threads using a tool known as the tap is referred to as tapping.
- This allows a cap screw or bolt to be threaded into the hole after it has been tapped.



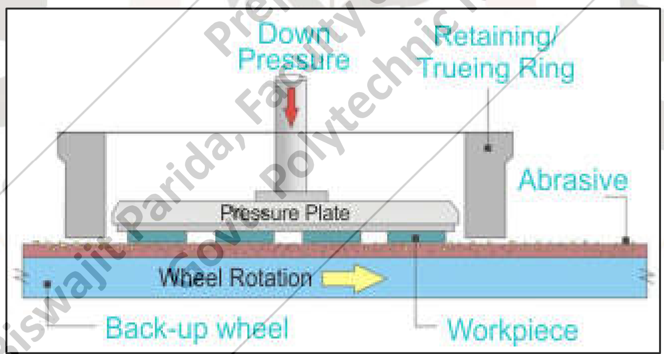
Schematic of Spot Facing Operation



Schematic of Tapping Operation

Lapping

- A type of machining in which two surfaces are rubbed against one another with an abrasive between them is Lapping.
- The lapping operation can be done on these machines where the main outcome of the lapping procedure is to produce truly flat and smooth surfaces.



Lapping Operation Diagram

Grinding

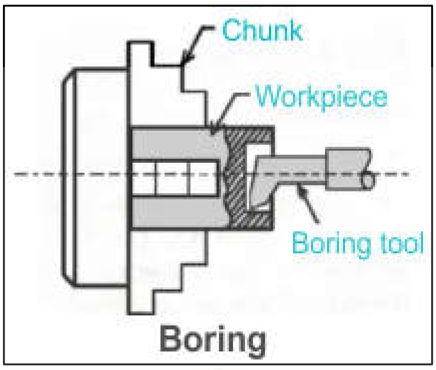
- A machining operation that uses a grinding wheel to remove the material from a workpiece is grinding.
- To finish or improve the roundness of a hole that has been drilled, the machine can perform a grinding operation.

Trepanning

- The process of creating a hole by removing metal using a hollow cutting tool is trepanning.
- This procedure is used to create big or larger diameter holes.

Boring

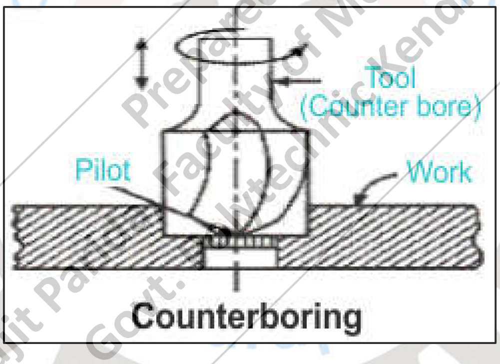
- A cutting process that entails enlarging an existing hole in a workpiece with a single-point cutting tool or boring head is known as boring.
- Sometimes, the process is done to correct the roundness of the previously drilled hole.



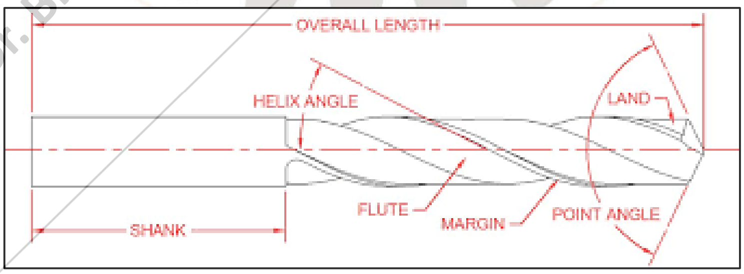
Schematic of Boring Operation

Counterboring

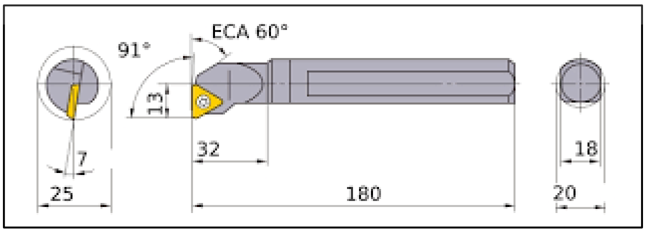
- The process of enlarging a hole over a particular section in the workpiece for screw clearance using counterboring tools is known as counterboring.
- This creates a shallow and enlarged cylindrical cut in the upper end of the hole to make a place for the head of a screw.



Schematic of Counterboring Operation



Drilling Tool

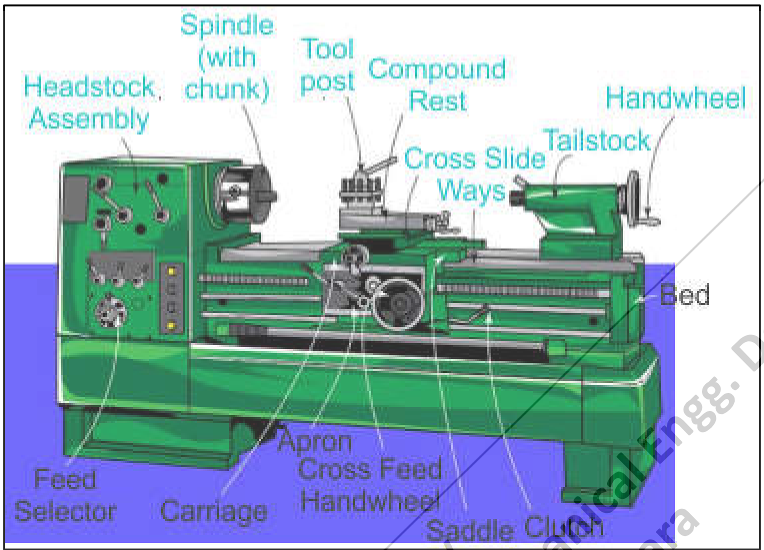


Boring Tool

Lathe Machine

- A lathe machine is a machine tool that is used to remove unwanted material from a rotating workpiece in the form of chips.
- This is accomplished with the use of a tool that traverses across the workpiece and feeds into it.

Lathe Machine Parts



Bed

The bed of the lathe machine serves as the foundation upon which all other components are installed.

Headstock

- The headstock is mounted on the left side of the lathe bed.
- Its primary duty is to transmit electricity to the components.
- It is a housing for a spindle where a chuck or live centre is provided that holds one end of the workpiece as it rotates.

Lathe Chuck

Chucks are specialised clamps made to hold objects having radial symmetry such as cylinders.

Lathe Spindle

- An essential rotating part of a headstock is the spindle.
- It contains a shaft that transfers rotary motion to the chuck, thereby turning the workpiece.

Tailstock

- The tailstock is a moveable casting opposite to the headstock that is mounted on the guideways on the bed.
- It holds tools for operations like drilling, reaming, tapping, etc., and supports the opposite end of the workpiece during machining. It includes the dead centre, adjustment screws, and handwheel.

Dead Centre

The workpiece is held in place while it is rotating using a dead centre (not freely rotated, i.e., dead).

Carriage

- The carriage can be found in the area between the tailstock and headstock.
- During operation, the carriage serves as a guide, supports, and feeds the tool against the workpiece. The following parts are on the carriage.

Saddle

- It is cast in the shape of an H and installed on top of the lathe.
- It supports the cross-slide, the compound rest, and the tool post.

Cross Slide

- It is positioned on the saddle such that it is perpendicular to the bed
- The cross slide hand wheel is turned to move the cross slide at a right angle to the axis of the lathe.

Compound Rest

- The compound rest joins the cross slide with the compound slide using a tongue-and-groove joint.
- It supports the cutting tool and tool post during the drilling of short tapers and shapes on forming tools.

Tool Post

- The tool post is mounted on the compound rest and is used to carry cutting tool holders.
- It is attached to the upper slide.
- The tool post is positioned on the top of the compound slide to securely hold the tools.

Apron

- An apron is the front section of a carriage.
- It includes all control keys.

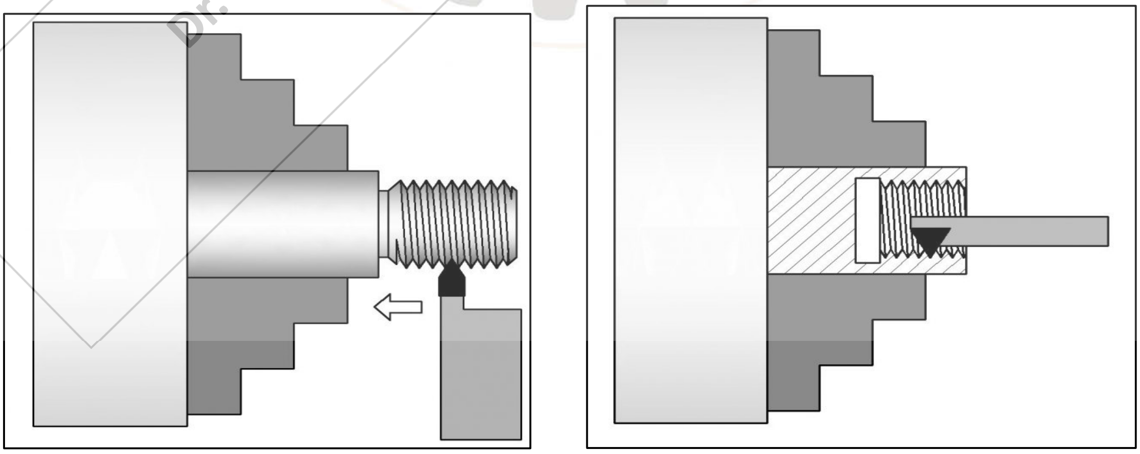
Leadscrew

- A leadscrew is used as a linkage in a machine to convert turning motion into linear motion.
- It is also referred to as a power screw or translation screw.
- The lead screw in a lathe machine is used to move the carriage along with the revolution of the spindle.
- Using various gears between the lead screw drive and spindle, threads can be created.

Thread Cutting in Lathe Machine

External Threading

- External threading on a lathe is a machining technique used to create threads on the outer surface of a workpiece, transforming it into a threaded shaft, bolt, rod, or other components.
- This process enables the workpiece to be joined with complementary internal threads or fasteners, facilitating secure connections.



External Threading Internal Threading

- Utilizing a cutting tool with the appropriate threading profile, the workpiece is rotated by the lathe's spindle while the cutting tool is fed along the length of the workpiece at a precise pitch.

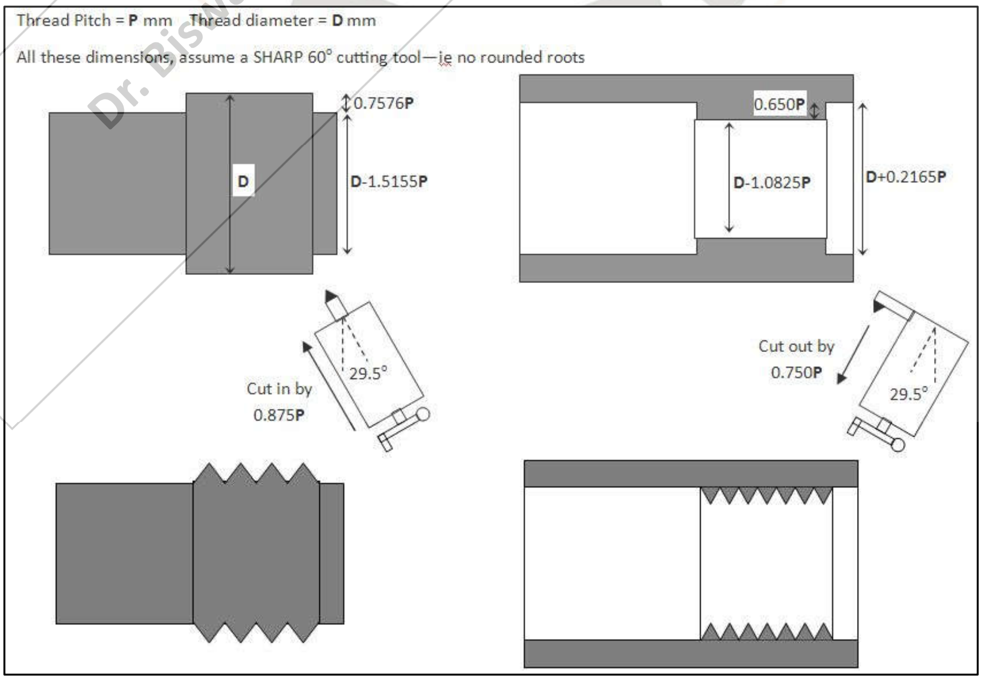
- As the cutting tool engages with the workpiece's surface, it removes material, gradually forming the external threads.
- Achieving accurate external threads requires careful control of variables such as thread pitch, cutting speed, and depth of cut to ensure correct dimensions and a smooth finish.

Internal Threading

- Internal threading on a lathe is a machining process that involves creating threads within a pre-drilled hole or bore in a workpiece.
- This operation allows for the integration of screws, bolts, and other threaded components, enabling secure fastening and assembly of parts.
- Using a specialized tool called a threading insert, the lathe's spindle rotates the workpiece while the threading tool is fed into the hole at a specific pitch to gradually form the internal threads.
- The tool's geometry corresponds to the desired thread profile, ensuring precise alignment and proper engagement with external threads.
- Threading on a lathe demands meticulous attention to parameters like thread pitch, cutting speed, and depth of cut to achieve accurate thread dimensions and a smooth surface finish.
- This process is widely utilized in industries such as manufacturing, automotive, aerospace, and more, where the creation of internal threads is critical for functional and structural components.

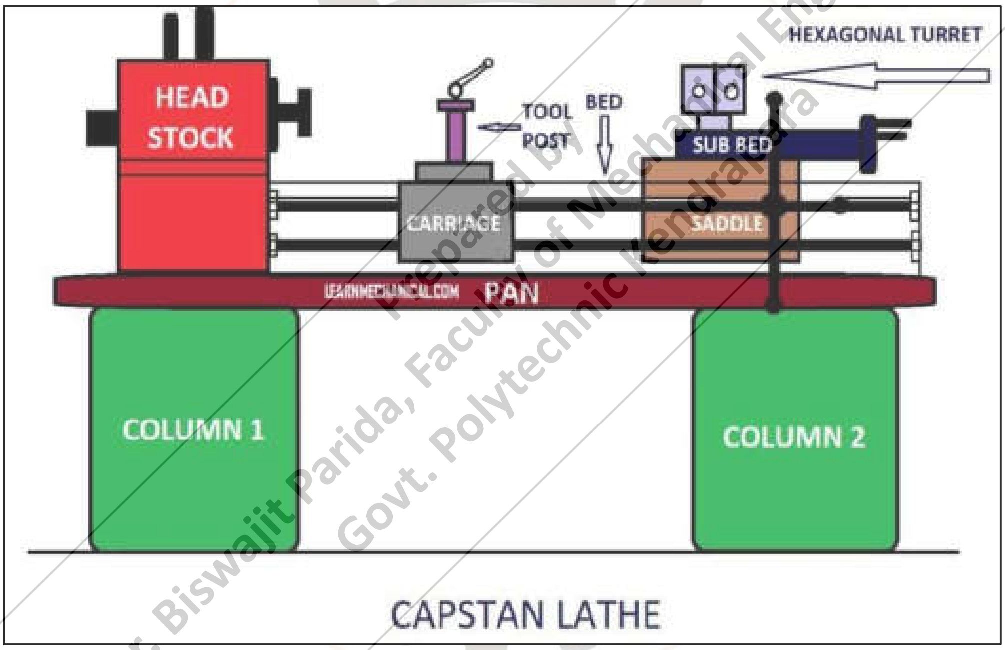
Some basic terms for threads:

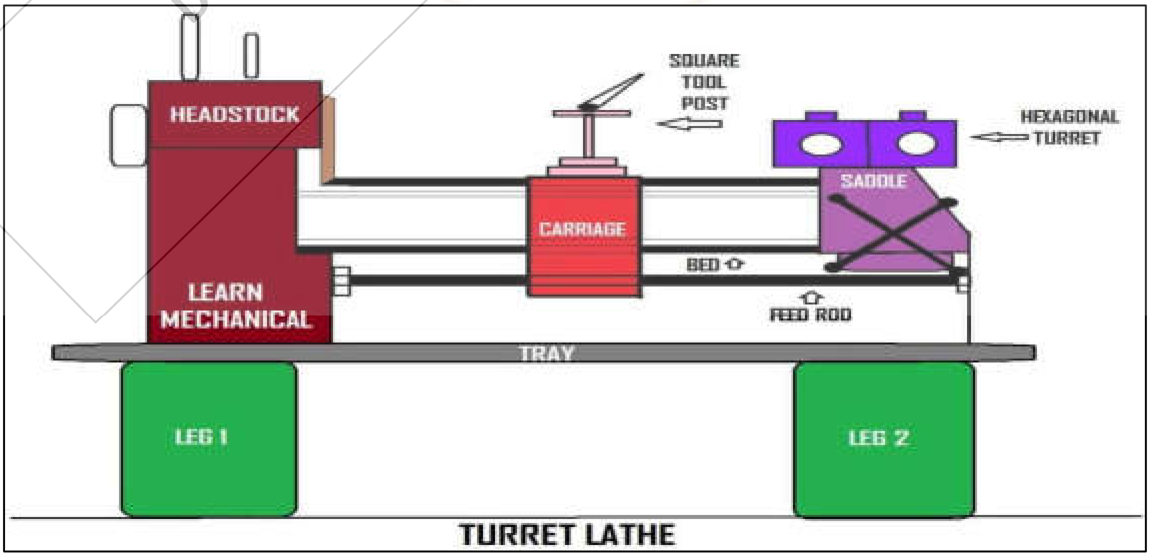
- _Pitch:_ It is defined as the distance between two points, measured from one point on a thread to another point in a similar position on a continuous thread, parallel to the cylinder axis.
- _Lead:_ It is defined as the distance that a thread moves in the axial direction during a complete rotation.
- _Major diameter:_ It is the maximum diameter of the thread, measured in the opposite direction from one vertex to the other.
- _Minor diameter:_ It is the smallest diameter of a thread measured in the opposite direction from one root to the other.
- _Number of threads per inch:_ As the name suggests, it is the number of threads in one inch. It is measured by placing the scale next to the threads and counting the number of pitches.
- _Depth:_ The distance measured between the vertex and the root in a direction perpendicular to the axis of the cylinder.



Capstan and Turret Lathe Machine

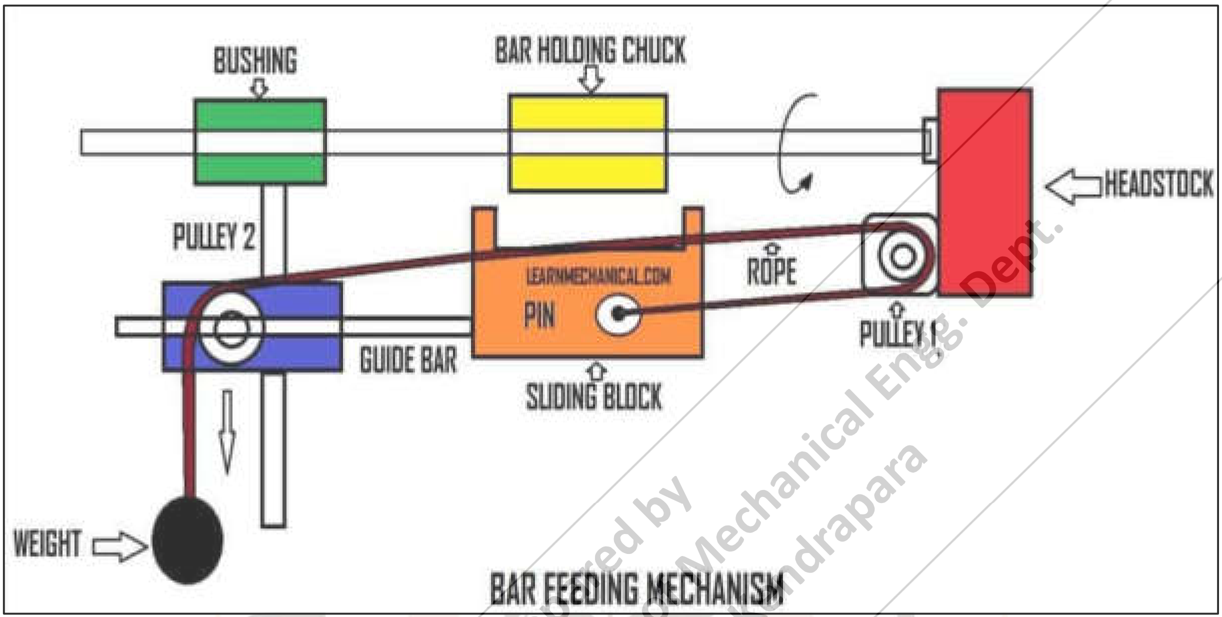
- A capstan and turret lathe is a production lathe.
- It is used to manufacture any number of identical pieces in the minimum time.
- In semi-automatic lathes machining operations are done automatically.
- Functions other than machining like loading and unloading of a job, the positioning of tools coolant operations are done manually.
- The turret head is mounted on the ram fitted with turret slides longitudinally on the saddle.
- Turret head has a hexagonal block having six faces with a bore for mounting six or more than six tools at a time.
- The threaded hole on these faces is used to hold the tools. In the case of a Capstan Lathe, the hexagonal turret is mounted on a short slide or ram which again fitted with a saddle.
- The saddle can be move accordingly throughout the bed ways and can be fixed to the bed if necessary.
- It is specially used for bar type jobs.
- But in the case of Turret Lathe, the hexagonal turret directly mounted on the saddle.
- The saddle can be move through the bed ways.
- Turret lathe is generally used for chucking type work.





The advantages of Capstan and Turret Lathe:

- The rate of production is higher
- Different ranges of speeds are obtained.
- A number of tools can be accommodated.
- Chucking of larger workpieces can be done.
- Operators of less skill are required hence lowers the labor cost.
- Higher rigidity so can withstand heavy loads.



Bar Feeding Mechanism in Capstan and Turret Lathe:

- In the bar feeding mechanism, the bar is pushed after the chuck is released without stopping the Lathe Machine.
- We use this mechanism for minimizing the setting time.
- The bar is passed through the pedestal bushing, bar holding chuck, headstock spindle, and the collet chuck.
- The collet chuck is screwed on the headstock spindle and holding the feed bar and also helps the bar to rotates as per spindle speed.
- Bar holding chuck rotates within the sliding block with the rotation of the feeding bar.
- One side of the rope is attached with the sliding block with the help of pin and another side of rope passes through 2 different pulleys and then connecting with a deadweight at its end.
- So now when the collet chuck released by the lever the dead weight tends to move in the downward direction, due to this it exerts thrust on the bar holding chuck and feed the bar until it touches the workshop.
- As we already have seen that Capstan Lathe is best for bar types jobs that's why we are generally seeing Bar Feeding Mechanism on Capstan Lathe.

ExperimentNo-04

Aim of the experiement:

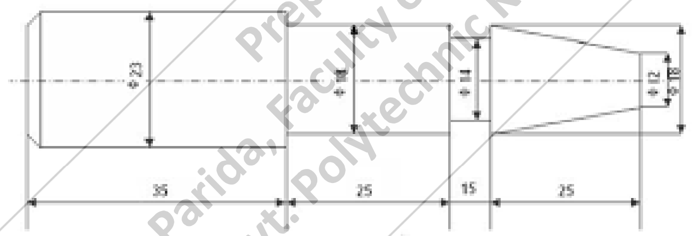
Job in evolving use of Capstan and turret lathe

Apparatus required:

Sl no.	Name of the apparatus	Specification	Quantity
01	Capstan turrentLathe	4’	01
02	Lathe Cutting Tool	4”	01
03	Chuck Key	100 mm	01
04	Box Spanner	10 mm	01

Raw material required:

M.S. Rod of Diameter 40mm and length 100mm.



STEP TURNING AND TAPER TURNING

ALL DIMENSIONS ARE IN MM

Procedure:

1. At first the round bar is fitted on the lathe chuck properly by the help of a surface gauge & chuck key.
2. Then checked out the centring of the job and tool by the help of surface gauge and dead centre respectively.
3. Now we run the lathe machine by making power switch on.
4. Then various operations are done by the help of capstan and turretlathe successfully.

Conclusion:

From this practice we have done Taper Turning & Chamfering operation by using capstan & turret lathe.

Aim of the experiement:

CNC Lathe Trainer Practice Job involving all turning process on MS Rod & aluminum rod for jobs using CNC Lathe trainer.

Theory :

Turning is a subtractive machining process that uses a cutting tool to remove material for creating cylindrical parts**.** The tool itself moves along the axis of the machined part while the part is rotating, creating a helical toolpath**.**

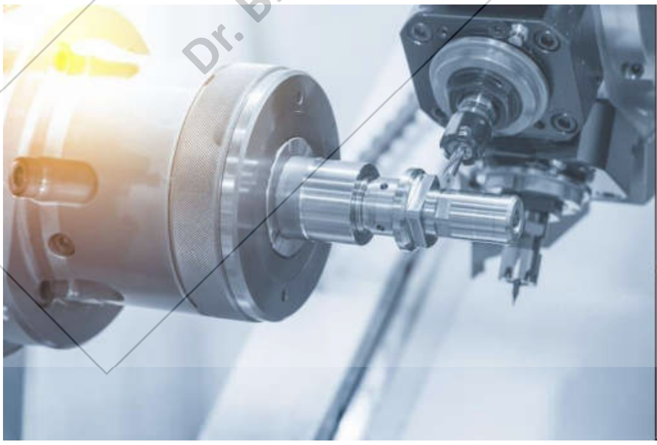
The lathe machine is historically one of the earliest of its kind for producing parts in a semi-automated fashion. Today, most companies provide CNC turning services. This means that the process is largely automated from start to finish.

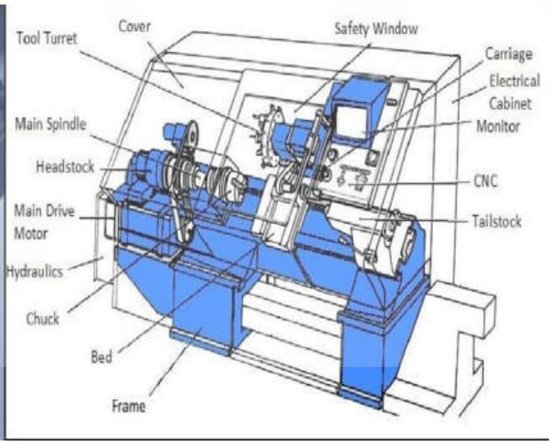
CNC refers to computer numerical control, meaning that computerised systems take control of the machinery. The input is digital code. This controls all the tool movements and speed for spinning as well as other supporting actions like the use of coolant.

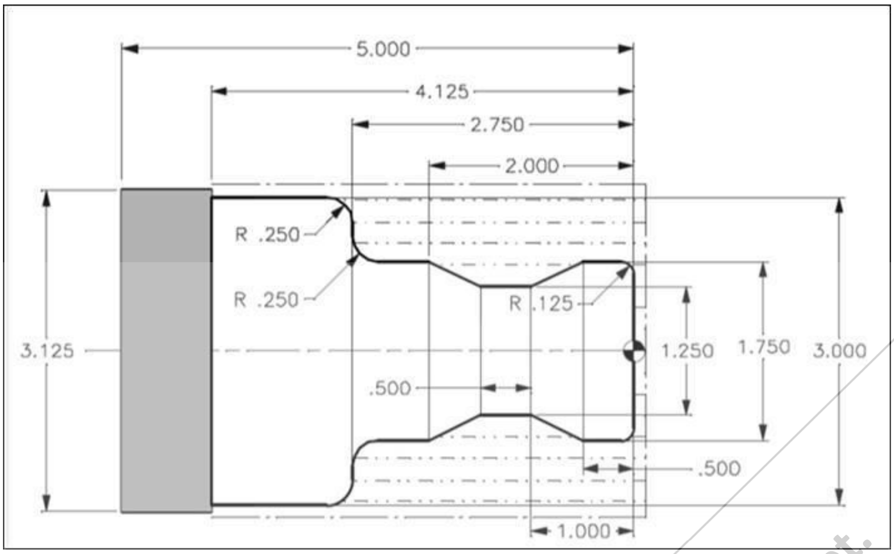
Procedure:

CNC Turning Process
What does the turning process actually comprise of? While the cutting itself is pretty straightforward, we are going to look at the whole sequence here which actually starts from creating a CAD file.
The steps of the process are:

- Creating a digital representation of the part in CAD
- Creating the machining code from the CAD files
- CNC lathe setup
- Manufacturing of the turned parts







Raw material required :M.S Rod , Aluminium

CAD design & G code
The first 2 steps can be seen as separate or going hand-in-hand. One way is to just use a CAD program to create the files and send them into production. The manufacturing engineer will then create the G code and the M code for the machining job.

Another way is to just use CAD-CAM software which lets the design engineer test the producibility of the part. The powerful simulation tools can visualise the whole process from raw material to the final product, even using the input regarding finishing requirements.

Lathe setup
Next comes the machine setup. This is where the machine operator's role becomes evident. Although contemporary CNC lathes do most of the work automatically, the operator still plays a vital part.
Steps for setting up a CNC turning centre:

- **Making sure the power is off**. CNC machining can be dangerous, so extra care is necessary and checking the power switch is the basis for that.
- **Securing the part into the chuck**. The chuck holds the part during the whole process. Improper loading can both pose dangers as well as result in a finished part with the wrong dimensions.
- **Loading the tool turret**. Turning comprises of many steps, so be sure to choose the right tooling for a certain finish. The turret can hold many tools at once for a seamless operation from start to finish.
- **Calibration**. Both the tool and part have to be set up in the right way. If anything is off, the result will not meet the demands.
- **Upload the program**. The last step before pushing the start button is uploading the code to the CNC machine.

Turning Parameters
The parameters of CNC turning depend on various aspects. These include the material of the part and tool, tool size, finishing requirements, etc.
The main parameters for CNC turning are:

- **Spindle speed**. The unit is rotations per minute (rpm) and it shows the rotational speed of the spindle (*N*), thus also the workpiece. The spindle speed is in direct correlation with the cutting speed which also takes the diameter into account. Therefore, the spindle speed should vary to maintain a constant cutting speed if the diameter changes considerably.
- **Workpiece diameter**. As said, this plays an important role to arrive at the right cutting speed. The symbol is *D* and the unit is mm.
- **Cutting speed**. The equation for calculating the cutting speed is $V=\pi DN/1000$. It shows the relative speed of the workpiece to the cutting tool.
- **Feed rate**. The unit is mm/rev and the symbol is *s*. Cutting feed shows the distance the cutting tool moves per one turn of the workpiece. The distance is measured axially.
- **Axial cut depth**. Pretty self-explanatory as it shows the depth of a cut in the axial direction. It is the primary parameter for facing operations. A higher feed rate puts more pressure on the cutting tool, shortening its lifetime.
- **Radial cut depth**. The opposite of axial cut, it shows the depth of cutting perpendicular to the axis. Again, lower feed rates help to lengthen the lifetime of tools and secure a better finish.

CNC Lathe Main Parts
Now, let's see the main components of a turning centre.
Headstock
The headstock of a CNC lathe makes up the front section of the machine. This is where the driving motor is along the mechanisms to power the spindle.
The chuck or collet attaches to the spindle. Either of them, in turn, holds the workpiece during the turning operation.
Chuck and collet
The chuck grips the machined part by its jaws. It attaches directly to the spindle but is replaceable, so different sized parts can be machined.
Collet is basically a smaller version of a chuck. The part size suitable for collets is up to 60 mm. They provide a better grip for small parts.

Tailstock
The other end of a CNC turning centre. A tailstock attaches directly to the bed and its purpose is to provide support for longer workpieces. The tailstock quill provides the support by hydraulic force.
The driving force still comes from the spindle and the tailstock just runs with the part. Using a tailstock is not suitable when face turning is necessary, as it will be in the way.
Lathe bed
The bed is just a base plate that rests on the table, supporting other machine parts. The carriage runs over the bed which is heat-treated to withstand the machining effects.
Carriage
The carriage rests on ways for sliding alongside the spinning workpiece. It holds the tools, allowing for cutting process to take place.
Turret
Newer machines usually come with a turret that replaces the carriage. They can hold more tools at the same time, making the switching from one operation to the other less time-consuming.
Control panel
This is where computer numerical control kicks in. The brains of CNC turning machines are just behind the panel. The panel itself allows the operator to adjust the program and start it.

Shaping Machine

- A shaping machine is a mechanical device used to shape and form metal workpieces.
- A type of machine tool that follows a linear toolpath with linear relative motion between the workpiece and a single-point cutting tool is a shaping machine or shaper.
- It operates by removing material through a reciprocating cutting motion, resulting in the desired shape or contour.

Base

- The base of the shaper holds all of the weight of the machine tool, and it is bolted to the shop floor.
- It is generally made of cast iron. It absorbs vibrations and other forces imparted during shaping operation.

Column

- The column is also made of cast iron in a box shape. It is set on the base of the shaper. It has precisely machined guideways on top that allow the ram to move back and forth. For the cross rail to move, there are guideways on the front vertical face. The ram-driving mechanism is inside the column. The base holds the column in place.

Table

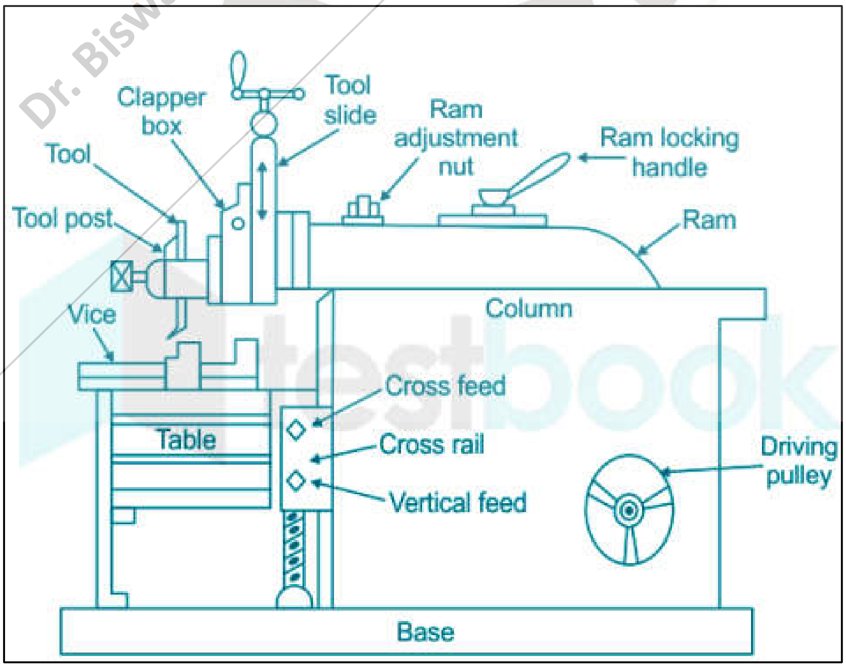
- The table is one of the crucial components of the device which is mounted on the saddle.
- The elevating screw and crossfeed rod can be turned to move the table both horizontally and vertically.
- It is a casting that resembles a box with precisely machined top and side surfaces.
- The table has T-Slots to clamp the work and is secured with support to increase rigidity.

Vice

- Clamp or vice is mounted on the table to hold the workpiece firmly while the shaping process is in progress.

Crossrail

- This part is fixed to the vertical guideways of the column.
- By turning an elevating screw, which enables the cross rail to glide on the vertical face of the column, the table can be elevated or lowered to meet the varying sizes of the task.



Saddle

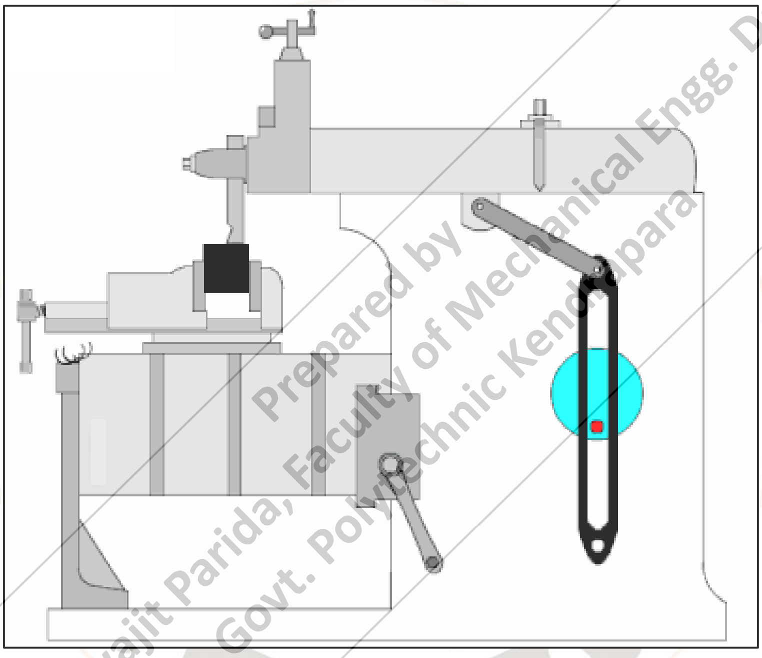
- It is fixed to the Crossrail securely on the top of the table. The rotation of the crossfeed screw causes the crosswise movement of the saddle which moves the table in the same direction.

Ram

- It is a component in the shaping machine that reciprocates using a quick return motion mechanism on the guideways at the top of the column while holding the tool in place.
- It contains a screwed shaft to adjust the working position.

Tool Head

- With the down-feed screw handle, the tool head secures the cutting tool and allows for both vertical and rotational movement.
- A tool head of shaping machine assembly has a vertical slide is made up of a swivel base with graduated degrees.



Advantages of Shaping Machines

- Single-point cutting tools are affordable.
- These machines have holding mechanisms for any workpiece.
- It can make sharp or smooth edges.
- The machine has a simple setup process and quick tool changes.

Disadvantages of Shaping Machine

- The cutting speed is slow and action happens only in the forward stroke.
- There is only one cutting tool and no other tools are utilised in this machine.
- There is a restriction of using one shaping tool at a time.

Applications of Shaping Machines

- Internal splines are made with a shaper machine.
- It makes straight and flat planes in horizontal, vertical, or angle.
- It can also make teeth for gears.
- Pulleys or gears can be made with keyways in these machines.
- It also makes shapes that are convex, concave or a mix of the two

Aim of the experiement:

Preparation of V Block on CI or MS Blocks by using shaper machine.

Tools and equipment required:

- Shaper machine
- Manual operating handle
- Shaper single point cutting tool

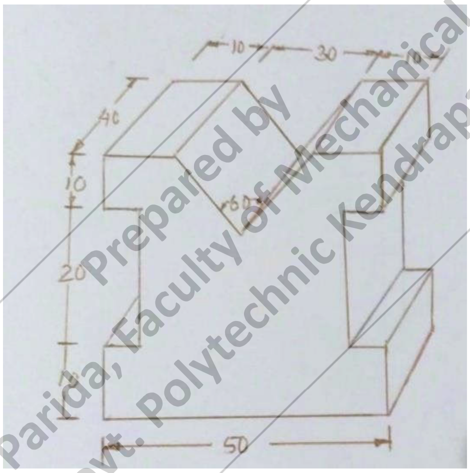
Marking and measuring tools:

- Scriber
- Dot punch
- Ball peen hammer
- Varnier caliper

Raw material required :

M.S block according to the given dimension in diagram (50×40 ×40)mm

Figure :



Procedure :

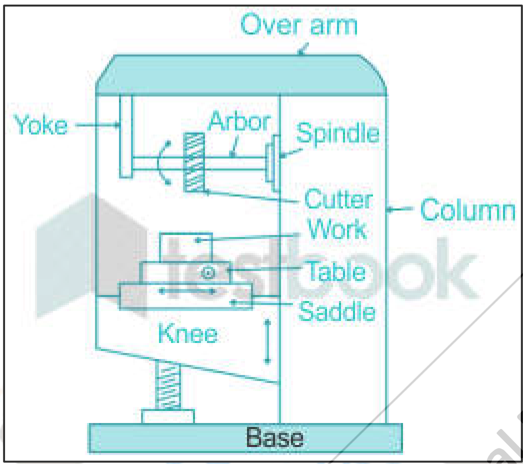
1. Take a block of dimension (50×50 ×50)mm then using proper marking media. Mark the block according to the given diaram.
2. Fix the raw material in the machine viceand also fix the required cutting tool in the tool post of the shaper machine
3. Set the swiveling tool post at proper angle
4. Then start the machine from zero feed depth to the required depth of raw material with the marking & make the v-block.

Conclusion :

From this practice we have done V Block on CI by proper machine tool & procedure.

Milling Machine

- The process of removing material from a workpiece by advancing rotary cutters cutter into it is called milling.
- The process is carried out by adjusting pressure, speed of cutter head, and direction of feed.
- A milling machine is a piece of equipment that removes a layer of material from the surface by using a multi-point cutting tool.



Base

- It supports every component of the machine and can dampen vibrations imparted by milling operations.
- Some machines have hollow bases that act as cutting fluid reservoirs.
- The base is generally constructed out of cast iron for rigidity.

Column

- The major supporting part, positioned vertically on the base, is the column.
- It is box-shaped.
- It contains the table feed drive mechanism and spindle.
- A dovetail guideway is provided at the front of its vertical face to support the knee.

Knee

- The knee, grey iron casting, slides along vertical guideways to modify the gap between the cutter and the workpiece on the table.
- This vertical motion is done by utilizing elevating screw provided below the knee.

Elevating Screw

- The elevating screw has threads that can provide upward and downward movement to the knee and table by rotating it using a handwheel.

Saddle

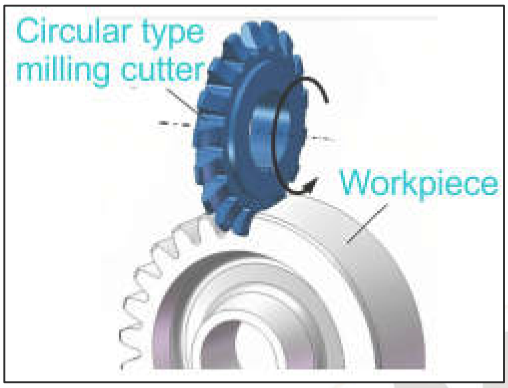
- The saddle is mounted on the knee at an angle of 90 ∘∘ to the face of the column.
- It can be moved transversely along the guideways on the knee.

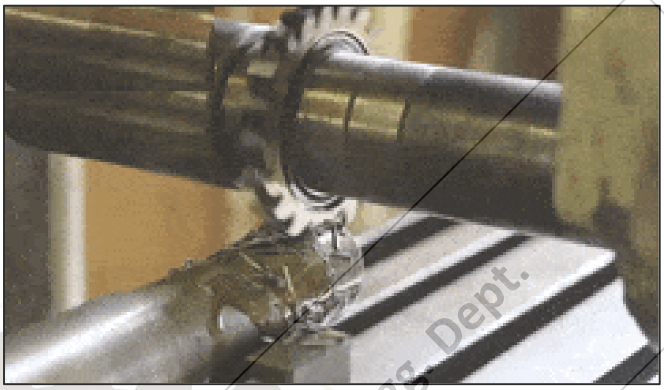
Table

- The table, mostly made of cast iron, rests on guideways in the saddle and provides support for the workpiece.
- And, this workpiece placed on the worktable is moved in either of the three directions:

Gear Cutting Operation

- A form-relieved cutter on a milling machine executes the gear-cutting operation.
- The cutter type may be either cylindrical or end mill.
- The cutter profile is made to precisely match the gear tooth spacing.
- A universal diving head is used to hold the workpiece while a process called indexing creates evenly spaced gear teeth on a gear blank.





- Indexing is the process of splitting the circumference of the workpiece into an arbitrary number of equal sections.
- The perimeter of the gear blank is divided into 'n' equal sections, and each tooth is milled individually.
- Almost all gear teeth divisions can be covered by index plates through crank rotation.
- The index crank is always next to the spindle making it easier to index the divisions to fractions of a turn. This is done to accurately cut the gear teeth spacing.

The movement of the index crank is calculated by a formula which is given below,

$$\text{Index Crank Movement} = 40/N,$$

where N → is the required number of divisions.

Aim of the experiement:

Preparation of Spur gear on CI or MS round by using milling m/c.

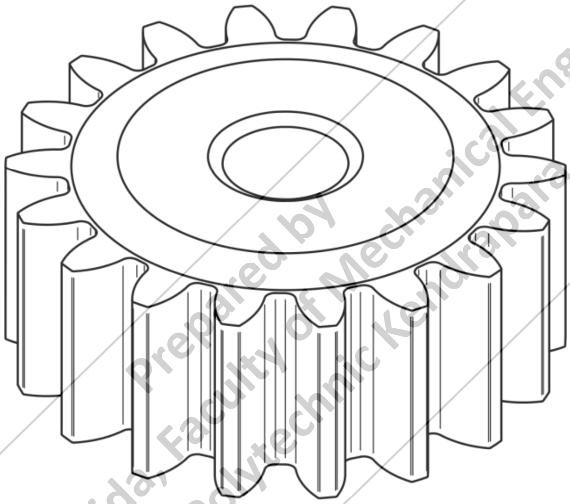
Apparatus required :

- Universal milling machine
- Spur gear milling cutter (Module 3)
- Spanner
- Indexing plate
- spindle rotating handles

Raw material required :

Circular M.S plate as per required diameter and thickness.

Figure :



(Take suitable dimension)

Procedure:

1. At first calculate the blank diameter of the material by selecting the required no. of teeth by the following formulae

Blank diameter = m(T+2)

m – Module

T – No. of teeth

2. Make a hole at the centre of the raw material for fixing at chulk according to the diameter of the spindle.
3. Fix the raw material in between the tail stock and chulk tightening.
4. Then fix the cutting tool in the arbor.
5. Calculate the depth of the teeth by the formula = 2.25 $\times$ m and Pitch = 3 $\times$ m
6. Again calculate indexing hole and rotation of the indexing spindle = 40/ No. of teeth
7. Now fix the depth of cut according to calculation.
8. Cut the teeth accordingly by the simple indexing method

Conclusion :

From this practice we finally able to make a spur gear by following proper M/C tool and procedure.

Aim of the experiment:-

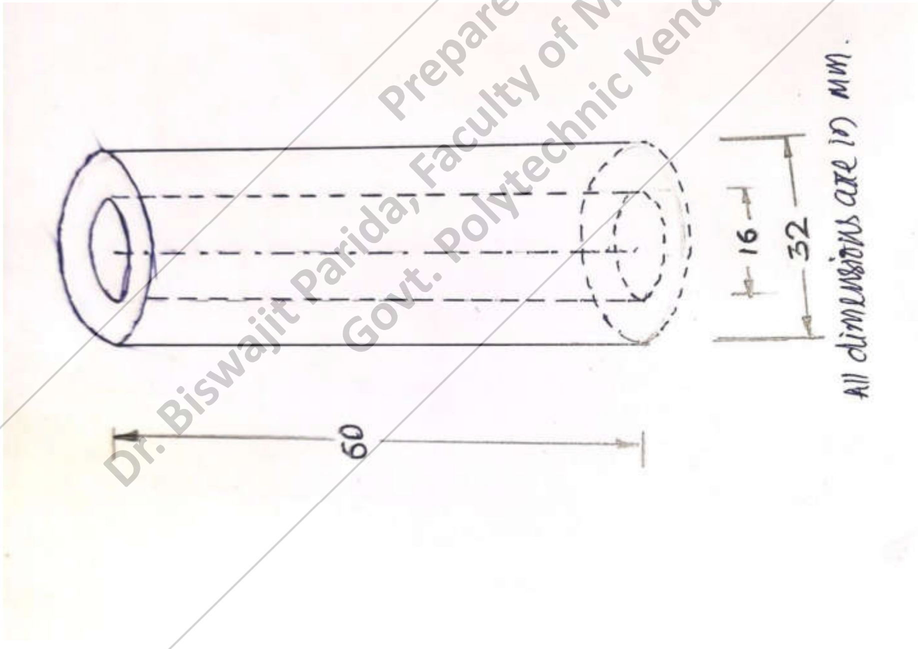
To do boring operation on a work piece using lathe.

Apparatus required:-

Sl no	Name of the apparatus	Specification	Quantity
01	Drill bit	Ø16 mm	1
02	Drill chuck	1-12 mm	1
03	Socket/Sleeve	1-2"	1
04	Lathe	4'	1
05	Boring tool	4"	1

Raw material required:-

MS ROD of diameter 32mm and length 60mm.



Procedure:-

- At first the workpiece is fitted properly on the lathe chuck by the help of a surface gauge & chuck key.
- Then facing and plain turning is done on the workpiece.
- The centre of the work piece is located by the help of tail stock.
- Now we run the lathe machine by making power switch on
- Now a drill bit is to be fitted with the tail stock and to be locked and then the drill will penetrated in to the rotating workpiece and sufficient feed is given until the required drilling is done.
- After drilling, the drill bit is removed and a boring tool is fitted into the toolpost.

- Then the boring operation is done by the boring tool which is generally used to enlarge the drilled hole.

Conclusion:-

Finally we did the boring operation on the given round bar.

Resources used (with major specifications)

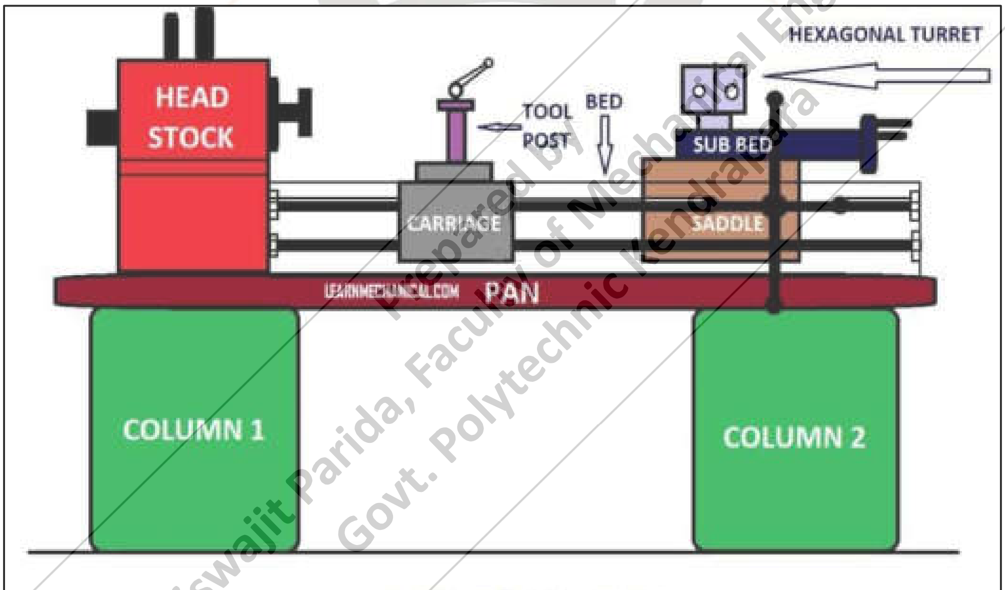
Sl no.	Name of the apparatus	Specification	Quantity
01			
02			
03			
04			
05			
06			
07			

Actual procedure followed:

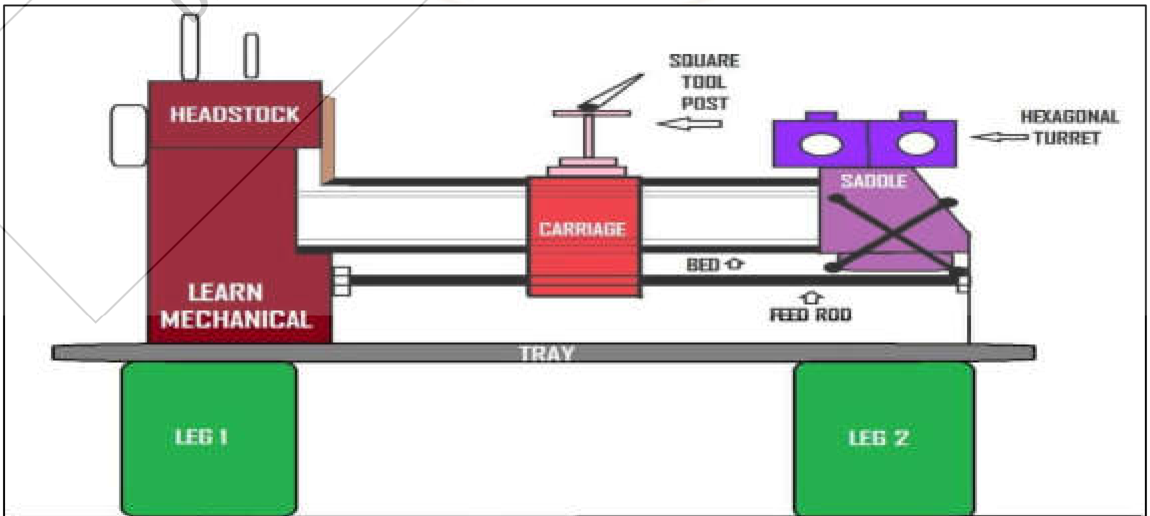
Precautions followed:

Capstan and Turret Lathe Machine

- A capstan and turret lathe is a production lathe.
- It is used to manufacture any number of identical pieces in the minimum time.
- In semi-automatic lathes machining operations are done automatically.
- Functions other than machining like loading and unloading of a job, the positioning of tools coolant operations are done manually.
- The turret head is mounted on the ram fitted with turret slides longitudinally on the saddle.
- Turret head has a hexagonal block having six faces with a bore for mounting six or more than six tools at a time.
- The threaded hole on these faces is used to hold the tools. In the case of a Capstan Lathe, the hexagonal turret is mounted on a short slide or ram which again fitted with a saddle.
- The saddle can be move accordingly throughout the bed ways and can be fixed to the bed if necessary.
- It is specially used for bar type jobs.
- But in the case of Turret Lathe, the hexagonal turret directly mounted on the saddle.
- The saddle can be move through the bed ways.
- Turret lathe is generally used for chucking type work.



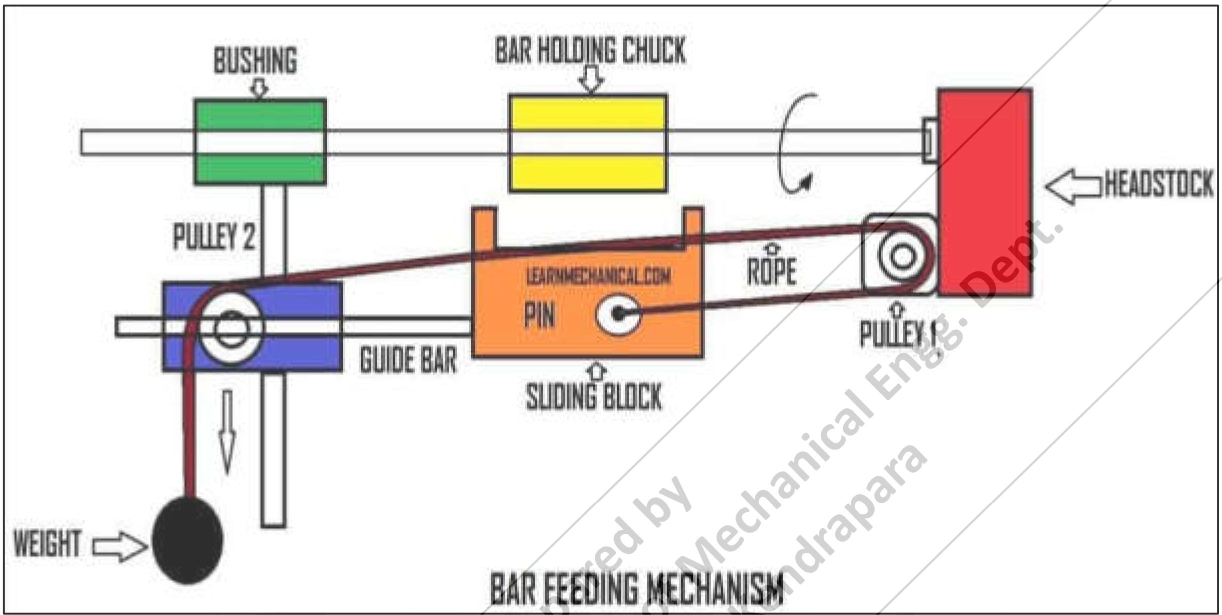
CAPSTAN LATHE



TURRET LATHE

The advantages of Capstan and Turret Lathe:

- The rate of production is higher
- Different ranges of speeds are obtained.
- A number of tools can be accommodated.
- Chucking of larger workpieces can be done.
- Operators of less skill are required hence lowers the labor cost.
- Higher rigidity so can withstand heavy loads.



Bar Feeding Mechanism in Capstan and Turret Lathe:

- In the bar feeding mechanism, the bar is pushed after the chuck is released without stopping the Lathe Machine.
- We use this mechanism for minimizing the setting time.
- The bar is passed through the pedestal bushing, bar holding chuck, headstock spindle, and the collet chuck.
- The collet chuck is screwed on the headstock spindle and holding the feed bar and also helps the bar to rotates as per spindle speed.
- Bar holding chuck rotates within the sliding block with the rotation of the feeding bar.
- One side of the rope is attached with the sliding block with the help of pin and another side of rope passes through 2 different pulleys and then connecting with a deadweight at its end.
- So now when the collet chuck released by the lever the dead weight tends to move in the downward direction, due to this it exerts thrust on the bar holding chuck and feed the bar until it touches the workshop.
- As we already have seen that Capstan Lathe is best for bar types jobs that's why we are generally seeing Bar Feeding Mechanism on Capstan Lathe.

Aim of the experiment:

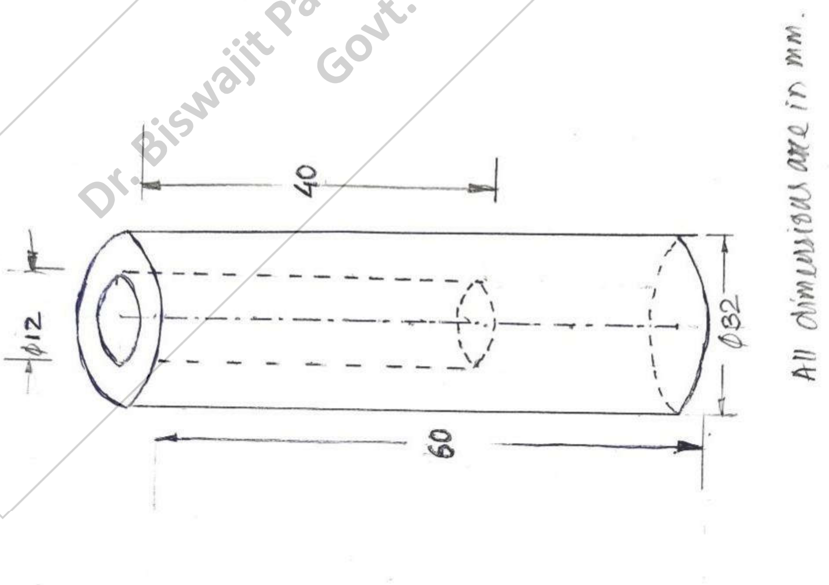
To make a drill on a round bar using lathe.

Apparatus required:-

Sl no	Name of the apparatus	Specification	Quantity
1	Drill bit	Ø16 mm	1
2	Drill chuck	1-12 mm	1
3	Socket/sleeve	1-2 “	1
4	Lathe	4’	1

Raw material required:-

MS ROD of diameter 32mm and length 60mm.



Procedure:-

- At first the round bar is fitted on the lathe chuck properly by the help of a surface gauge & chuck key.
- Then facing operation is done on the job and after that plain turning is done.

- Locate the centre of the work piece by using tailstock.
- Now the dead centre is removed from the tailstock and a socket with sleeve and a drill bit fitted into it.
- Now we run the lathe machine by making power switch on.
- After this the drill bit is required to move forward by the tail stock hand wheel which will penetrate into the rotated job and drilled the required sized hole.

Conclusion:-

Finally we made a drill (Ø12 mm) on the given round bar.

Resources used (with major specifications)

Sl no.	Name of the apparatus	Specification	Quantity
01			
02			
03			
04			
05			
06			
07			

Actual procedure followed:

Precautions followed:

Observations: