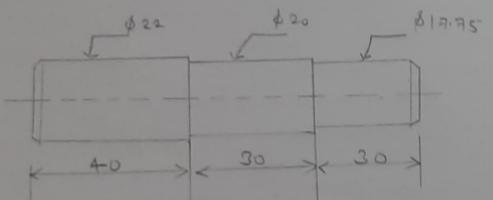


Object :- To perform facing, step turning and Chamfering on lathe machine as per drawing.

### Facing:

Facing in the context of turning work, involves moving the cutting tool at right angles to the axis of rotation of the rotating workpiece. This can be performed by the operation of the cross-slide. If one is fitted as distinct from the longitudinal feed (turning). It is frequently the first operation performed in the production of the workpiece, and often the last, hence the phrase "ending up".



Step turning:- In this process of step turning the work piece is fixed in between the chucks with the help of tool feed that is used to produce provided along the longitudinal direction with required depth of cut. Step turning operation is used to produce a cylindrical surface by removing the excess materials by providing the required depth.

Knurling :- It is the process of embossing a diamond shaped irregular patterns on the surface of a work piece using a special knurling.

Chamfering:- Chamfering is the operation of beveling the extreme end of a work piece. This is done to remove the burrs, to protect the end of the work piece from being damaged & to have a better look. The operation may be performed after turning, rough turning, boring, drilling. Chamfering is an essential operation before thread cutting so that the nut may pass freely on the threaded work piece.

### Viva Questions

Q1 What is knurling operation? Explain its working on lathe.

Ans Knurling is a manufacturing process that involves rolling a knurling tool against a workpiece to create a pattern of lines. The tool deforms the surface of the workpiece creating a pattern of lines.

Q2 Discuss the knurling about daily user tools. It refers to the process of creating a textured pattern of raised ridges on the surface of a tool handle. Commonly found on items like wrenches, pliers, screwdrivers, and other handheld tools, enhancing user control & safety by providing a better tactile surface to hold onto.

Q3  
Ans

Classify the knurling operation.

There are several types of knurling operations including hand knurling, machine knurling, straight knurling, diamond knurling, floating, knurling and concave / convex knurling.

Q4

What are the difference between knurling and chamfering operation?

#### Knurling

- (i) It creates rough surface
- (ii) Performed on round or cylindrical part and often of flat surface

#### Chamfering

- Creates a beveled edge
- Creates a sloping edge or corner of a workpiece

Q5

Ans

What is turning operation? Its classify.

Turning is a machining operation that involves removing material from a rotating workpiece using a cutting tool. It can be used to create internal & external surface.

#### Types

- (i) Knurling → Creates a serrated or diamond shape.
- (ii) Threading → Cuts threads into the outer surface.
- (iii) Broaching → Creates a narrow cut in the base material.
- (iv) Facing → Creates smooth, flat surface on the end.
- (v) Reaming → Enlarge existing holes.
- (vi) Polygonal turning →

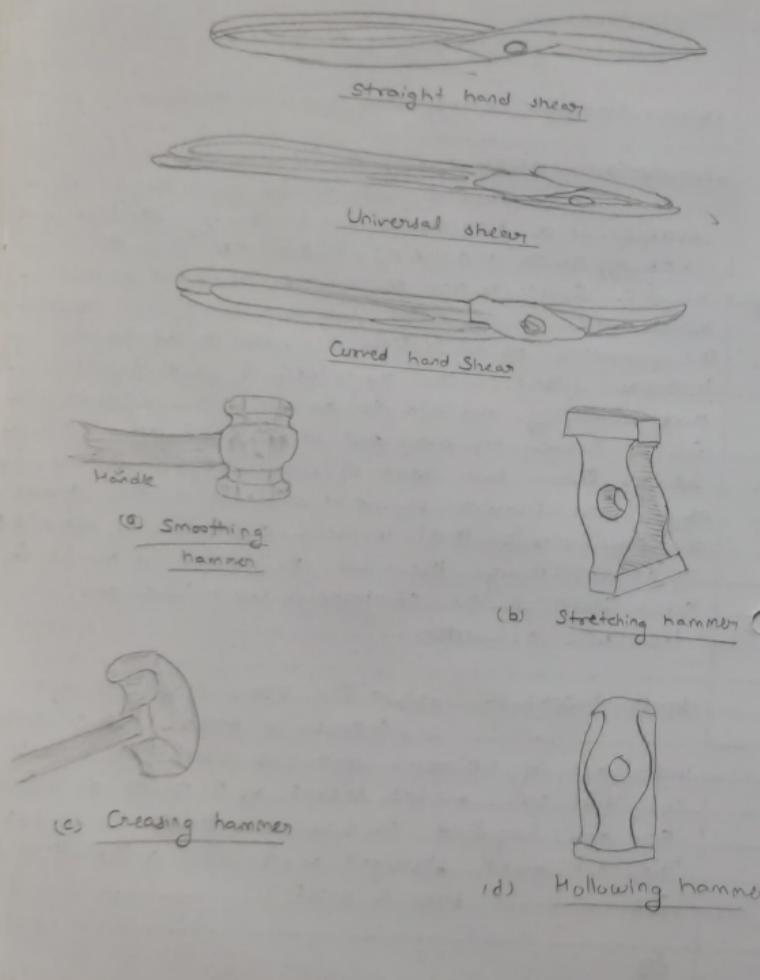
Experiment No. 2 (A)

Aim:- Study the Fitting Shop and its tools.

Introduction:- Most of semi-finished works can be accomplished with fairly good degree of accuracy in a reasonable time through various kinds of quick machining operations. They still require some minor operations to be performed to finish the job by hand. The term bench work denotes the production of an article by hand on the bench. Whereas fitting is the assembling of parts together and removing metals to secure the necessary fit, and may or may not be carried out at the bench. These two types of work require the use of a large number of hand tools and other devices or equipments that involves a number of operations of accomplishing the work to the desired shape & size. Some of the commonly used tools are discussed as under.

Hand Shears or Snips:- Fig shows the types of hand shears or snips. They resemble with pair of scissors and are used like them to cut thin soft metal sheets of 20 gauge or thinner. They are required to size and shape the sheets. They can make straight or circular cuts. Different Types of hand shears are:-





Straight hand shear: - It is used for general purpose cutting, making straight cuts and trimming away extra metal.

Universal shear: - Its blades are designed for universal cutting straight line or internal and external cutting of contours. It may be of right hand or left hand type, easily identifiable, as the top blade is either on the right of on the left.

Curved hand shear: - It is used for cutting circular or irregular curved shapes ranging from 20 to 35 cm.

Hammers: - Fig. Shows the various types of hammers used in sheet metal work for

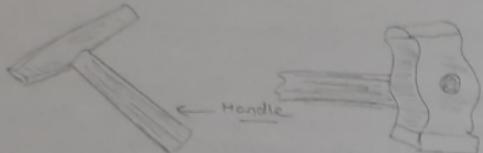
smoothing hammer - Smoothing hammer is used for leveling & smoothing a sheet metal joint.

stretching hammer - Stretching hammer is used for stretching sheet.

creasing hammer - Creasing hammer is used to close down joint edges of sheet metal part.

Hollowing hammer - Hollowing hammer is used for hollowing sheet metal part. It is used for generating sharp radii also.

Riveting hammer - Riveting hammer is used for forming riveted heads.



(e) Riveting hammer



(f) Plashing hammer

plashing hammer:- It is used for removing small marks or indentations from the sheet metal job surface to true the shape of the work. It smoothes off the finished.

Measuring Tools:- There are a fairly large number of measuring tools used in sheet metal shop, which are described in detail along with relevant figures in chancery with fitting work. The most commonly used measuring tools are given as under.

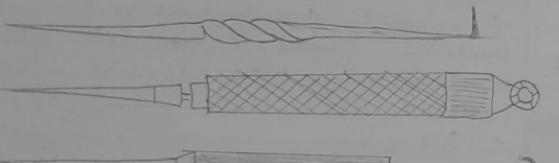
1. Folding rule
2. Circumference rule
3. Steel rule
4. Vernier caliper
5. Micrometer
6. Thickness points gauge.

Miscellaneous Hand tools-

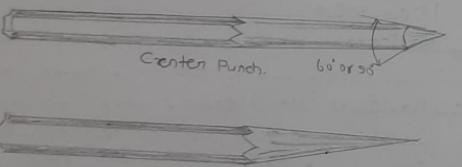
- |                  |                    |
|------------------|--------------------|
| 1. Steel square  | 5. Trammel points  |
| 2. Straight edge | 6. Soldering iron. |
| 3. Dividers      | 7. Pliers          |
| 4. Scribes       |                    |

some of the commonly used hand tools are described as under.

Folding Rules:- It is used in measuring & laying out on sheets larger work with accuracy of 0.5mm. Steel rules:- It is used in measuring & laying out small work on sheets. It can also measure upto accuracy of 0.5 mm.



Various type of Scribers



Typical Prick &amp; center punch

Tinman's mandrel:- The body of tinman's mandrel consists of a flat part & circular parts and serves as a base for carrying out several operations on sheets.

Pliers:- Flat nose and round nose type pliers are commonly used for holding the sheet work and forming different shapes respectively.

Scribers:- Fig. shows the different kinds of set scribers, which are made of hardened steel of 2-5 mm. diameter & 200mm long. Its one end is pointed as sharp as possible for making scribing lines on metal sheets.

Prick Punch:- Fig. Shows the prick punch, which is used for indentation marks. It is used to make small punch marks on layout lines in order to make them last longer. The angle of prick punch is generally ground to 30° or 45° whereas for centre punch it is kept 60° or 90°.

Centre Punch:- Fig. Shows the centre punch, which is used for locating centre for Indentation mark, for drilling purpose.

Surface Gauge or Scribing Block:- Fig. illustrate the surface gauge which is a principal marking tool used generally in the fitting and the machine shops. It is made in various forms & size. It consists of a cast iron sliding,

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base fitted with the vertical steel rod. The scribe or marker is positioned or set into an adjustable device using a knurled nut at one end. The marker is used to set it at any desired inclination, moved to and fro inside the hole accommodating it or adjusts its height along the vertical pillar.

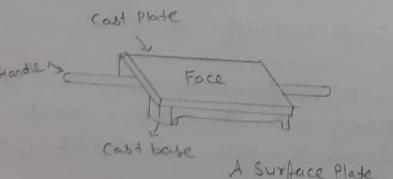
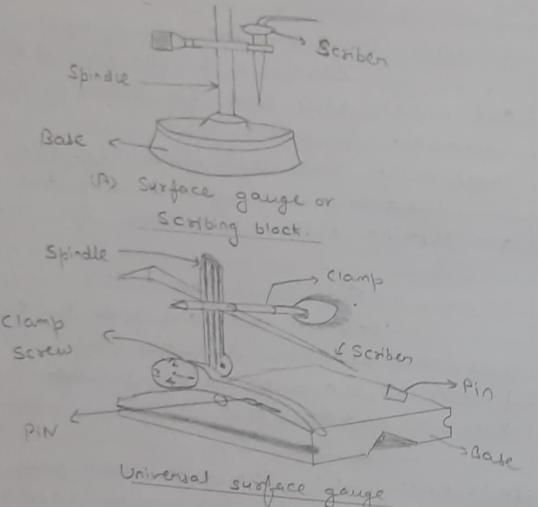
Universal Surface Gauge :- Fig. Shows the universal surface gauge, which is an improved variety of the surface gauge simple scribing block. It is designed in such a way that appreciably finer adjustments can be made very quickly.

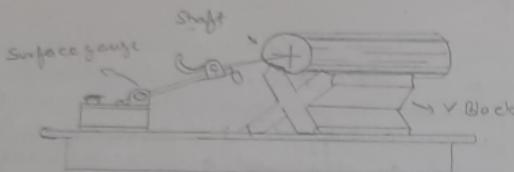
It consists of a cast base perfectly machined & ground at the top, bottom and all sides. The base of the gauge usually carries a V-shaped slot at the bottom so as to render it suitable for use on round object. Two guide pins are provided at the rear end of the base, which can be pressed.

Measuring Devices :- There are some general purpose measuring devices such as fillet and radius gauge, screw pitch gauge, surface plate & try square which are described as under.

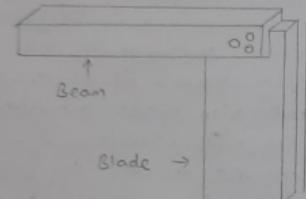
Fillet & Radius Gauge

Surface plate :- Fig. Shows the surface plate, which is a cast iron plate having generally a square top well planed and square with adjacent machined faces. The top surface of the plate is





A use of Surface plate & V block



A try Square

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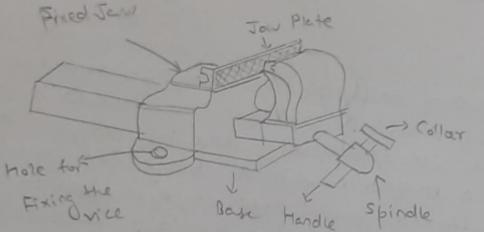
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finished true by means of grinding and scrapping. It possesses a cast iron base, which is also machined true to keep the top surface of the plate in a perfect horizontal plane. Its specific use is in testing the trueness of a finished surface, testing a try square, providing adequate bearing surface for V block & angle plates, etc. in scribbling works.

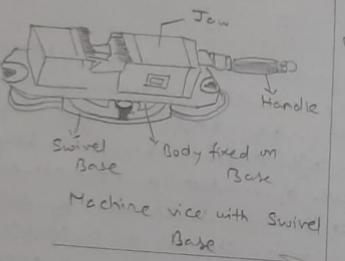
Try Square :- Eg. shows the try square, which is also known as engineering's try square. It is very important tool required for scribing straight lines at right angles to a true surface or testing the trueness of mutually normal surfaces. It is made in different sizes out of steel pieces. In construction, it is similar to a carpenter's try square but is comparatively more accurate. It can be made either as one piece or in two pieces.

It consists of a steel blade fitted into a steel stock of rectangular cross-sections. It is sufficiently hardened and tempered to suit the need. Some precision kind of try square is made with their blades having leveled edges properly ground and finished square.

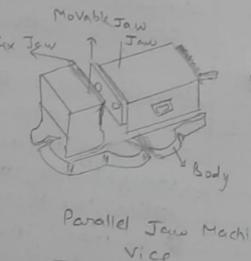
Holding Tools - Holding tool used in fitting shop comprises of basically vises and clamps. The clamps are C or L clamp, plane slot, goose neck, double end finger, U-clamp, parallel jaw, & <sup>etc.</sup>



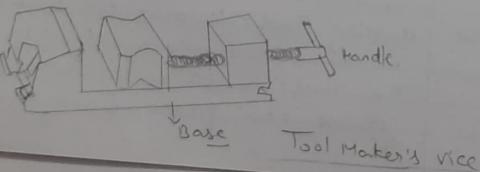
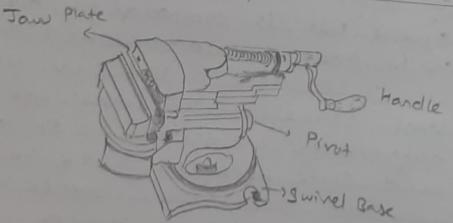
A Bench vice



Machine vice with Swivel Base



Parallel Jaw Machine Vice



Tool Maker's vice

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and clamping block.

Vices :- The vices are hand vice, bench vice, machine vices, carpenter vice, shaper vice, leg vice, pipe vice and pin vice.

Bench vice :- Fig. shows a bench vice commonly used in fitting shop for holding a variety of jobs.

Machine vice :- Fig shows machine vice with swivel base & parallel jaw machine vice. These type of vices are commonly used in fitting shop for holding a variety of jobs. They are used for generally made of grey cast iron.

Universal swivel base machine vice :- Fig shows a special type of universal swivel base machine vice made with swiveling head. It is commonly used in fitting shop for holding a variety of jobs. The jobs after holding in jaws can be adjusted at any angle either horizontally or vertically with the help of swiveling head.

Tool maker's vice :- Fig. shows a small tiny vice known as tool maker vice. It is commonly used by tool maker, watch maker, die maker & goldsmith for holding a variety of small parts for carrying some operation.

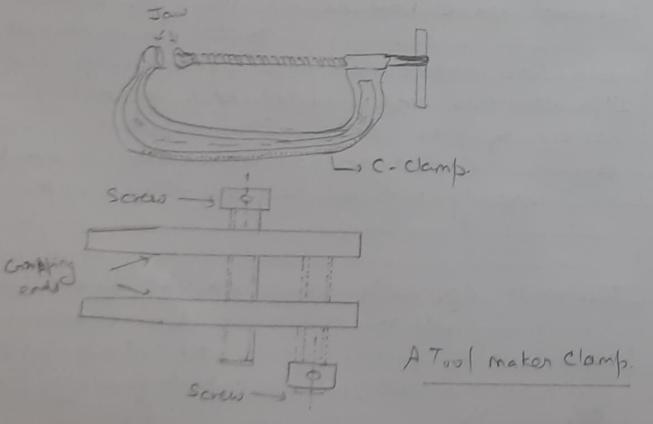


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Hand vice:- It is shown in fig. which is utilized for holding keys, small drills, screws, nuts, and other similar objects which are very small to be easily held in the bench vice. This is made in various shapes and sizes. It consists of two legs made of mild steel which hold the jaws at the top and are hinged together at the bottom. A flat spring held between the legs which tend to keep the jaws open. Its jaws can be opened & closed by a wing nut which moves through a screw that is fastened to one leg to pass through the other.

Pin vice:- Pin vice is used for holding round jobs of small diameter such as wire & pins during working. It also forms a very useful handle for small files. It consists of a handle & a tapered nose covering a small collet chuck at its end. The chuck carries the jaws which are operated by turning the handle. It is commonly used by a watch maker.



Clamping Devices:- There are two types of clamps namely C clamp & tool maker clamps. A C-clamp is shown in Fig. which is used for gripping the work during construction or assembly work. Whereas tool maker clamp is used for gripping or holding smaller jobs.

Cutting tools:- sheet metal shop uses cutting tools, which are described in details in upcoming chapter, to fitting work along the irrelevant figures. Commonly used cutting tools involves types of files, chisels, scrapers & hacksaw. some of the commonly used cutting tools are discussed as under.

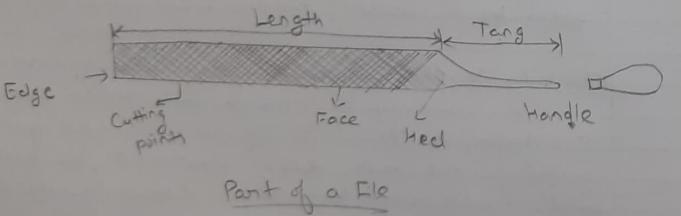
Files:- These are flat, square, round, triangular, knife, pillar, needle and mill types.

Chisels:- The flat chisels and round nose chisel are mostly widely used in sheet metal work.

Scrapers:- These are flat, hook, triangular, half round types.

Hacksaw:- Hacksaw used in sheet metal shop may be hand hacksaw or power hacksaw. \* The important common cutting tools are discussed below:-

Files:- The widely used hand cutting tool in workshops is the file. It is a hardened piece of high grade steel with slanting rows of teeth. It is used to cut, smooth or fit metal parts. It is used file or cut softer metals. It consists of the following parts as shown in Fig. The tang is the pointed part, which fitted into the handle. The point is the end opposite the tang. The heel is next to the handle. The safe edge or side of a file is that which has no teeth. It is classified on bases of type or cut of teeth and sectional form.





(a) Single cut file



(b) Double cut file



(c) Rasp cut file

Size of a File :- Size of a file is specified by its length. It is the distance from the point to the heel, without the tang. Files for fine work are usually from 100 to 200 mm & those for heavier work from 200 to 450 mm in length.

#### Classification of Files:-

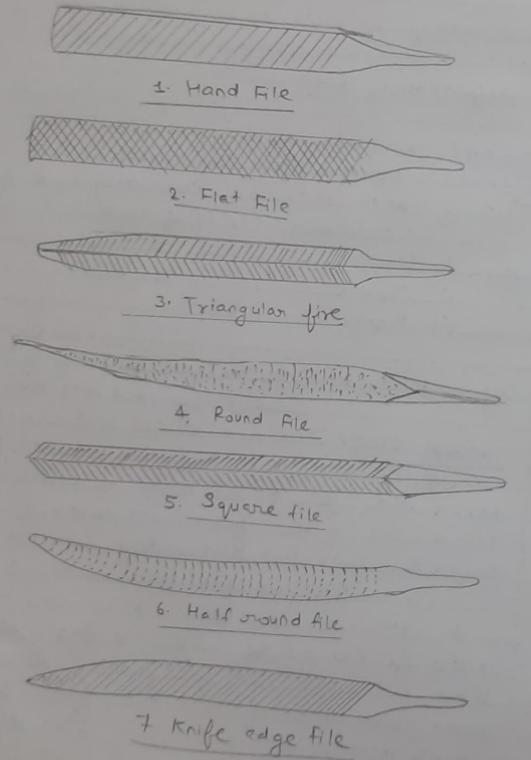
The files are classified on basis of type of cuts, grade and shapes. These are further sub classified as under:

Type of Cut :- The most commonly used files according to cuts of teeth are shown in

- Fig. i) Single
- ii) Double
- iii) Rasp.

Cut or teeth on Files :- Teeth or cuts of files can be categorized into two groups namely single cut and double cut. In single cut files, the teeth are cut parallel to other across the file, at an angle of about  $60^\circ$  to the centre line of the file. Such types of file are named as flats and are widely used on hard metals.

A double-cut file possesses two sets of teeth, the over-cut teeth being cut at about  $60^\circ$  & the up-cut at  $75$  to  $80^\circ$  to the centre line. These files are used for finishing general surface work. Both faces of files are double cut and both edges are single cut. Such files are commonly



tapered in width & thickness

General classification of files based on shapes or cross sections are shown in Fig. along with their uses are as under.

Hand files:- Hand files are commonly used for finishing surface work. Both faces of the files are double cut. Either both edges are single cut or one is uncut to provide a safe edge.

Flat files:- Flat files are generally used for filling in corners flat surfaces in fitting shop.

Triangular files:- Triangular files are commonly used for filing corners between 60° & 90°. They are double cut on all faces.

Square files:- Square files are commonly used for filling in corners in jobs. They are double cut on all sides & tapers.

Round files:- Round files are generally used for opening out holes & rounding inside corners. Rough, bastard, second cut & smooth files under 15 cm in length are single cut.

Half round files:- These files comprises of flat & half round sides. The flat side of half round files are used for general work and the half round side for filling concave surface. These files are double cut on the flat side. The curved side is single cut, smooth or second cut.

Knife-edge files :- These files are commonly used for cleaning out acute-angled corners. The two faces of these files are double cut, while the edge is single cut, while the ~~the~~. These files are made in sizes from 10cm to 20cm of various shapes & cuts. They are extremely delicate & are used for fine work such as pierced designed in thin metal.

Pillar files :- These files are used for finishing narrow slots. Both faces are double cut and either both edges are single cut or one is uncut to provide a safe edge of the file.

Needle files :- Needle files are generally used for filling keys tooth wheels of chucks & other curved surfaces.

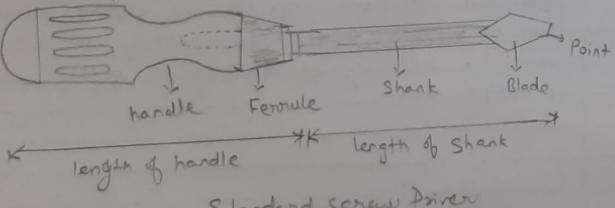
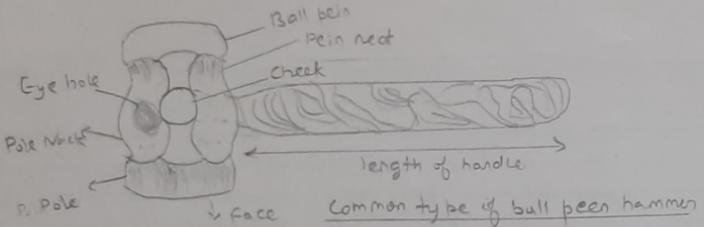
Mill files :- Mill files are commonly used for filling half round recess & gullet of mill.

Chisel :- Chisel is one of the most important tools of the sheet metal, fitting and forging shop. It is widely used for cutting & chipping the work piece. It is made of high carbon steel or tool steel. It is in the form of a rod having cutting edge at one end. Hexagonal or octagonal body & striking head at the other end. The size of a chisel is described by its length and width of edge. When the cutting edge becomes blunt, it is again sharpened by वंश

by grinding. For cutting the job or work piece with the chisel, it is placed vertically on the job or work piece & hammering is carried out upon its head. But for chipping, the chisel is inclined at  $40^\circ - 70^\circ$  with the job or work piece. The angle of the cutting edge of the chisel is  $35^\circ - 70^\circ$  according to the metal to be cut.

Hand Hacksaw:- Hand hacksaws are made in two types namely a fixed frame & adjustable frame oriented as shown in fig. The former possesses solid frame in which the length cannot be changed & where as the latter comprises the adjustable frame which has a block that can be lengthened or shortened to hold blades of different sizes.

The hand hacksaws are commonly used for sawing all soft metal. They consist of a frame, handle, prongs, tightening screw and nut, and blade as shown in figure. Its frame is made to hold the blade tightly. However a power operated hacksaw can also be used for cutting raw materials in sizes in case of continuous cutting generally occurring frequently in fitting or in machine shops.



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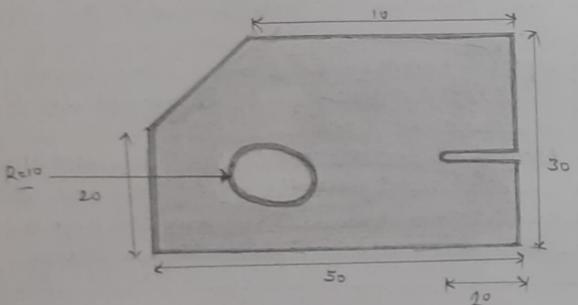
Striking tools:- various types of hammers (Such as ball peen hammer, straight peen hammer, cross-peen hammer, double face hammer & soft face hammer) are acting as striking tools. These types have been described in chapters relating to sheet metal work & forging work. The common type of ball peen hammer and their parts are shown in Fig.

Tightening Tools:- The tightening tools include pliers, screw driver & wrenches, which are discussed as under-

Pliers:- Pliers are namely ordinary needle nose & special types. Fig. shows long nose pliers & a combination pliers. These are commonly used by fitter and electrician for holding a variety of jobs.

CO	1	2	3
Mapping	✓	✓	

PO a b c d e f g h i j k l m  
mapping

Experiment 2 (B)

Object:- To prepare a given metal work piece.

Material required :- mild steel.

Equipment Required:- Fitting rule, Try square, marking gauge, scribe, Bench vice, saw, chisel, punch, Hammer etc.

Procedure:-

- Hold the piece in the Bench vice tightly.
- File the all the faces of Metal piece properly according to the determine dimension.
- Mark the entire dimension on the piece with help of marking gauge.
- Again fit the job for round surface at the corner according to figure.
- After this make a drill of 20 mm dia. with the help of Drill machine.
- In the end make threads in the hole with the help of threading tape etc.

Safety Precaution:-

- Use sharp tools carefully in shop.
- Use chisels and files with a properly fitted tight handle.
- Apply force only in the forward cutting stroke relieve the force on the return stroke.
- Hold the material (Metal piece) tightly in vice

- Check dimension time to time.
- Never keep tools on head stock of machine.

### Viva Question

Q1 Name of any five measuring instruments?

Ans Measuring instrument -

- |                  |                          |
|------------------|--------------------------|
| (i) Folding rule | (ii) Circumference rule. |
| (iii) Steel rule | (iv) Vernier caliper     |
| (v) Micrometer   | (vi) Thickness gauge.    |

Q2 What is the name of vice used in fitting shop?

Ans The vice commonly used in a fitting shop is called a bench vice.

Q3 Which tools are used in fitting shop?

Ans A fitting shop uses a variety of tools, including marking tools, cutting tools, measuring tools, holding tools & striking tools.

Marking tools → marking table, height gauge, angle plate  
✓ block surface gauge, scriber.

Cutting tools → Cold chisels, hacksaws, files, Drills, Tap.

Measuring tools → steel rule, calipers.

Holding tools → Vices.

Q4

What is the use of center punch?

Ans

A center punch is a tool used to mark the exact center of a point on a material.

Q5

Which are the sheets of metals?

Ans

'sheets of metals' refer to flat, thin pieces of various metals like stainless steel, aluminum, copper, galvanized steel, carbon steel, brass & tin.

Q6

What are the different types of hammers?

Ans

There are many different types of hammers, including claw hammers, sledge hammers, ball hammers, peen hammers, framing hammers & dead blow hammers.

Q7

Name different type of chisels?

Ans

Bench chisel, firmer chisel, mortise chisel, paring chisel, and construction chisel, Hammered chisels, cold chisel, Bolster chisel.

Q8

What is sawing?

Ans

Sawing is a process that involves cutting a material using a toothed or abrasive tool.

Q9

What is mean by drilling?

Ans

Drilling is a process that involves cutting holes into materials using a rotating tool.

Q10

Name the material used for making the Job in fitting shop?

Ans

Mild steel.

