

**GENERAL MACHINIST**  
**PRACTICAL I & II**  
**VOCATIONAL EDUCATION**  
**HIGHER SECONDARY - SECOND YEAR**

A Publication under  
Government of Tamilnadu  
Distribution of Free Textbook Programme  
( NOT FOR SALE )

Untouchability is a sin

Untouchability is a crime

Untouchability is inhuman



**TAMILNADU**  
**TEXTBOOK CORPORATION**  
**College Road, Chennai - 600 006.**

© Government of Tamilnadu  
First Edition - 2011

*Chairperson*

**Dr. R. RAJKUMAR,**

Head of the Department ( Mechanical )  
AMK Polytechnic College,  
Sembarambakkam, Chennai - 602 103.

*Authors*

**G. JAYAKUMAR JESUDOSS,**

Vocational Teacher,  
Dharmamurthi Rao Bahadur Calavala Cunnan Chetty's  
Hindu Higher Secondary School,  
Thiruvallur - 602 001.

**C. RAVIVARMAN**

Vocational Teacher,  
Govt. Boys Higher Secondary School,  
Nattrampalli,  
Vellore Dist - 635 852.

**A. VELAYUTHAM**

Vocational Teacher,  
Govt. Higher Secondary School,  
Nemili,  
Vellore Dist - 631 051.

**B. PRABHAKARAN**

Vocational Teacher,  
Govt. Boys Higher Secondary School,  
Vandavasi,  
Thiruvannamalai Dist-604 408.

**N. PALANIVELU**

Vocational Teacher,  
Govt. Boys Higher Secondary School,  
Arni,  
Thiruvannamalai Dist - 632 301.

This book has been prepared by the Directorate of School Education on behalf of the  
Government of Tamilnadu

This book has been printed on 60 GSM paper

Printed by Web Offset at :










# GENERAL MACHINIST PRACTICAL - I

## CONTENTS

Ex. No.	Date	Title of the exercise	Page No.	Teacher's signature
1.		Facing	8	
2.		Facing and plain turning	10	
3.		Step turning	14	
4.		Step turning and chamfering	18	
5.		Taper turning	22	
6.		Knurling	26	
7.		Grooving	30	
8.		Undercutting	34	
9.		Collar turning	38	
10.		Plain and taper turning	42	

## GENERAL MACHINIST PRACTICAL - II

### CONTENTS

Ex. No.	Date	Title of the exercise	Page No.	Teacher's signature
1.		Filing, marking & punching	46	
2.		 cutting	50	
3.		 cutting	54	
4.		 cutting	58	
5.		 cutting	62	
6.		 cutting	66	
7.		 cutting	70	
8.		 cutting	74	
9.		 cutting	78	
10.		 cutting	82	

# **GENERAL MACHINIST**

## **PRACTICAL - I**

Note : All the dimensions are given in mm. The diameter of the round rod is given as 20 mm.  
The design of the exercises may be modified according to the size of the material available.



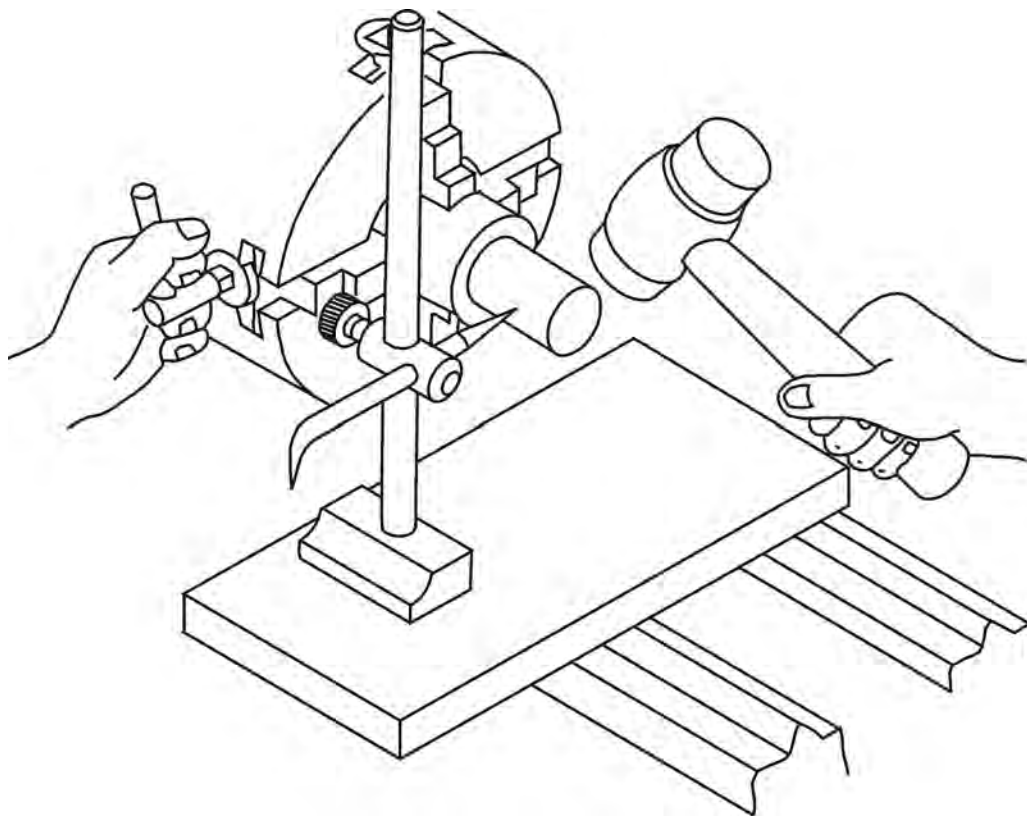
## **Points to be considered while working on a lathe**

Some important points are to be considered before setting on to work on a lathe. They are

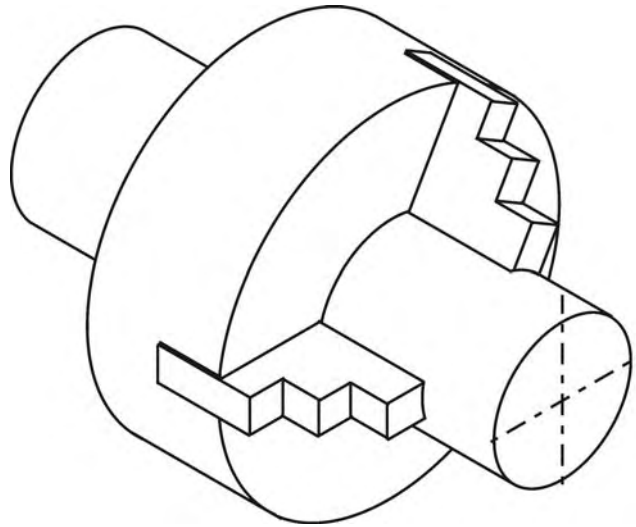
1. The suitable method of holding different types of work according to their shape.
2. Selection of proper cutting speed according to the size, weight, material of the work and the type of the operation.
3. Selection of proper cutting tool.
4. Mounting of the selected tool on the tool post.

The following illustrations are given to provide a good idea of holding a work, cutting speed, types of tools and setting of the tool.

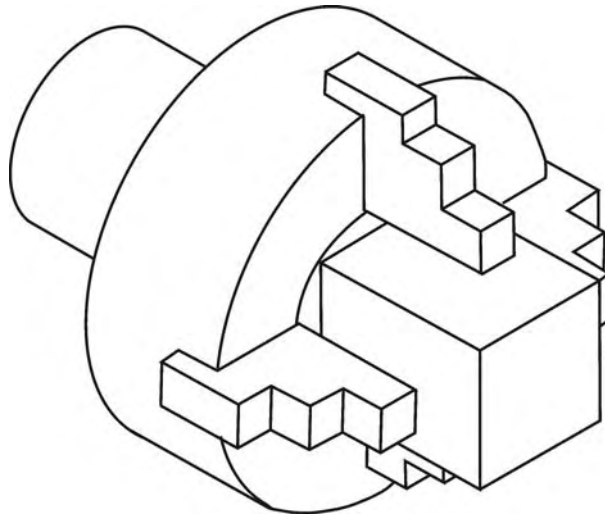
### **Holding of the work**



**The method of setting the work in a four jaw chuck with the help of a surface gauge**



**A cylindrical work is held in a three jaw chuck**



**A rod of square section is held in a four jaw chuck**

## **Cutting speed**

Speed can be defined as the distance an object moves in a particular time. In a lathe, the cutting speed is the distance travelled by a point on the outer surface of the work in one minute. It is expressed in meters per minute.

$$\text{Cutting speed} = \frac{\pi d n}{1,000} \text{ m/min.}$$

Where 'd' - is the diameter of the work in mm.  
 'n' - is the r.p.m. of the work.



**Table showing cutting speed for various materials**

Work material	Cutting tool material		
	High speed steel	Tungsten steel	Stellite
Mild steel	30 m/ min	80 m/ min	58 m/ min
High carbon steel	26 m/ min	65 m/ min	50 m/ min
Cast steel	15 m/ min	80 m/ min	42 m/ min
Cast iron	22 m/ min	80 m/ min	50 m/ min
Aluminium	90 m/ min	400 m/ min	330 m/ min
Brass	61 m/ min	200 m/ min	33 m/ min

**Tools used in a lathe**

*A. According to the construction, the lathe tools are classified into three types*

1. Solid tool
2. Brazed tipped tool
3. Tool bit and tool holders

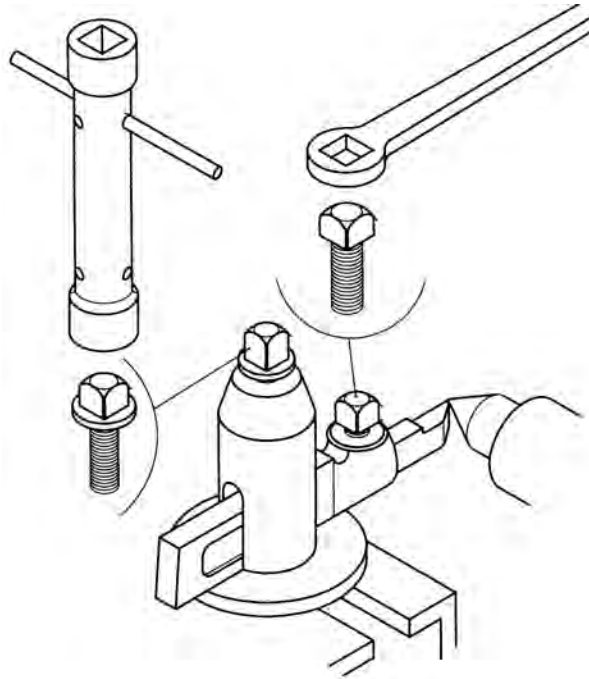
*B. According to the operation to be performed, the cutting tools are classified as*

1. Turning tool
2. Thread cutting tool
3. Facing tool
4. Forming tool
5. Parting tool
6. Grooving tool
7. Boring tool
8. Internal thread cutting tool
9. Knurling tool

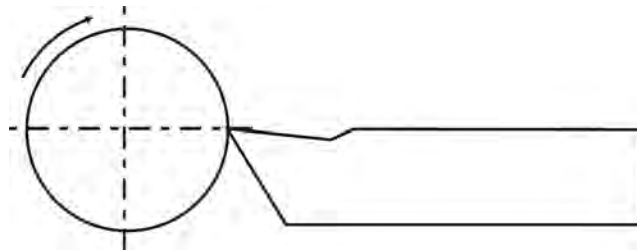
*C. According to the direction of feed movement, the following tools are used*

1. Right hand tool
2. Left hand tool
3. Round nose tool

## Method of mounting the cutting tool on the tool post

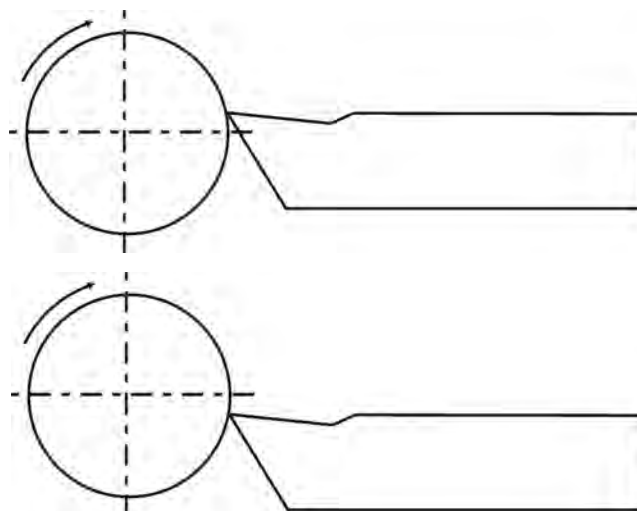


### Correct method



The cutting edge of the cutting tool is positioned exactly aligned to the axis of the lathe spindle

### Incorrect methods

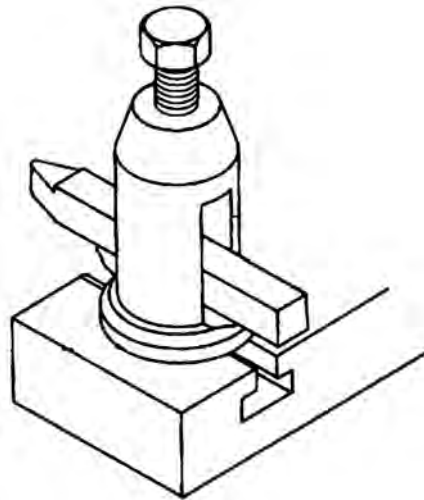


If the cutting edge of the cutting tool is positioned above the axis of the lathe spindle, the front clearance surface of the tool drags on the work. The cutting edge loses its cutting capacity due to wear.

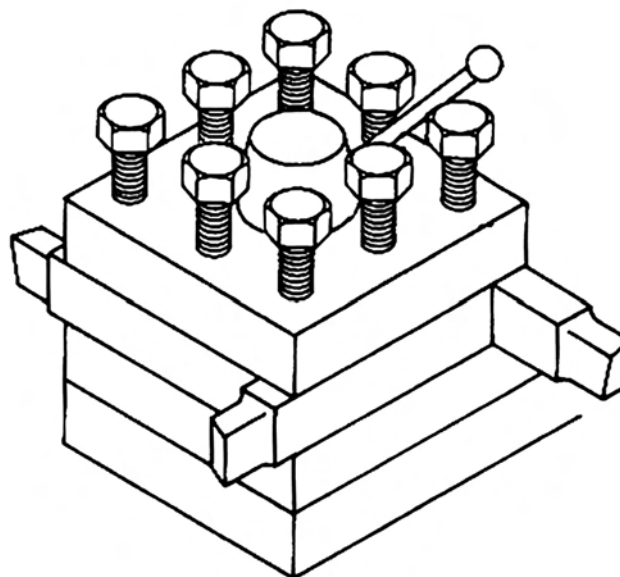
If the cutting edge of the cutting tool is positioned below the axis of the lathe spindle, the cutting edge loses its keenness. When the tool is provided with depth of cut, the work rides over the tool. The cutting edge may be broken and the work surface is damaged.

## **Types of toolposts**

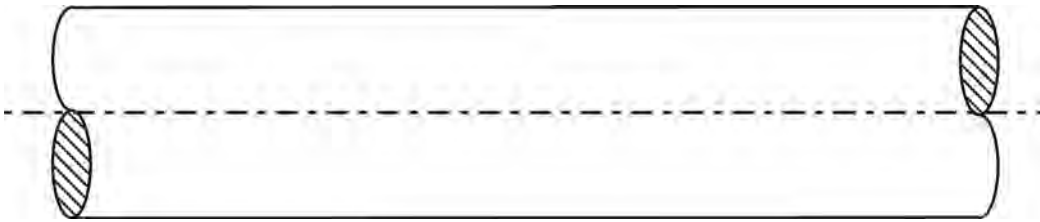
### **Single screw toolpost**



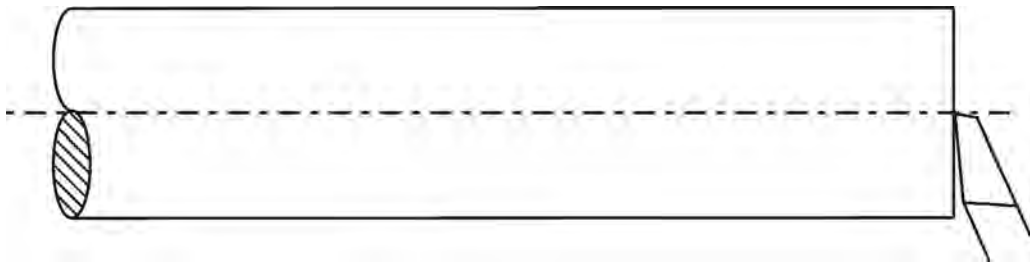
### **Four way toolpost**



## Exercise - 1 (Facing)



### Operation - 1



# 1. FACING

## **Aim**

To machine a flat surface on the face of the given round rod (Facing)

## **Required instruments**

1. Facing tool
2. Chuck key
3. Tool holder
4. Steel rule
5. Vernier caliper
6. Surface gauge

## **Tool setting**

A facing tool is mounted on the toolpost and its cutting edge is set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0° mark.

## **Holding of the work**

1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

## **Selection of cutting speed**

$$\text{Cutting speed} = \frac{\pi dn}{1,000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.

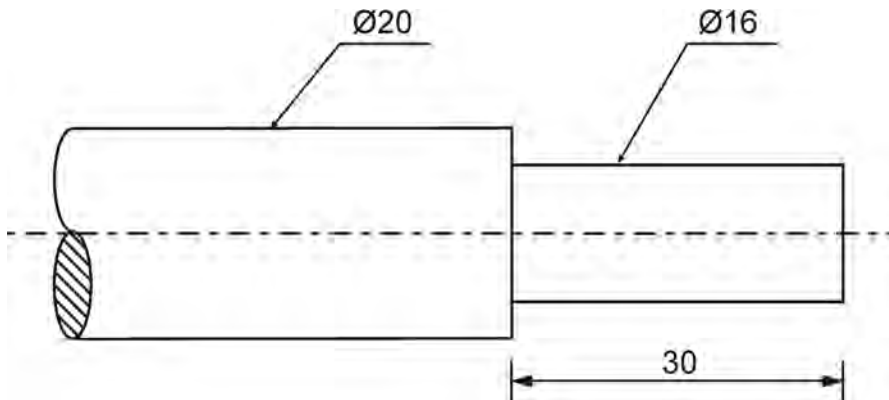
## **Procedure**

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

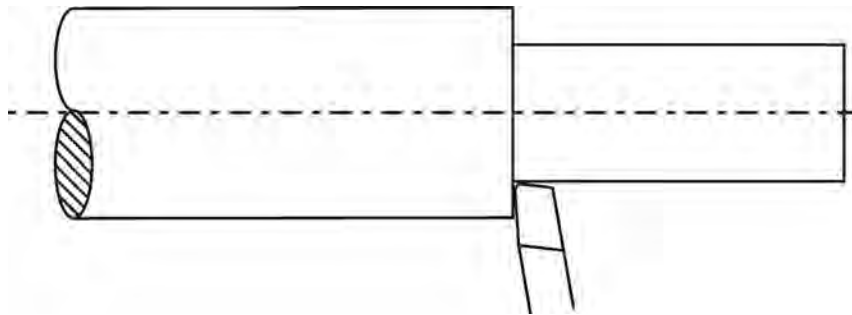
## **Result**

The finished piece of work is sent for inspection after the machining is over.

## Exercise - 2 (Facing & plain turning)



### Operation - 1



All dimensions are in mm

## 2. FACING AND PLAIN TURNING

### Aim

To machine a flat surface on the face of the given round rod (Facing) and to perform plain turning operation to produce a cylindrical part of given dimensions.

### Required instruments

1. Facing tool
2. Plain turning tool
3. Chuck key
4. Tool holder
5. Steel rule
6. Vernier caliper
7. Outside caliper
8. Inside caliper
9. Surface gauge

### Tool setting

A facing tool and a plain turning tool are mounted on the toolpost and their cutting edges are set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0° mark.

### Holding of the work

1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

### Selection of cutting speed

$$\text{Cutting speed} = \frac{\pi dn}{1,000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.





## **Facing operation**

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

## **Marking**

Marking is done on the work at the required point to indicate the length to be plain turned.

## **Procedure**

1. The cross-slide is adjusted for required depth of cut and the lathe is switched on. The plain turning tool mounted on the toolpost is given feed by the carriage parallel to the lathe axis.

2. The above process is repeated until the required diameter is obtained. This is done by gradually moving the cross-slide after each cut.

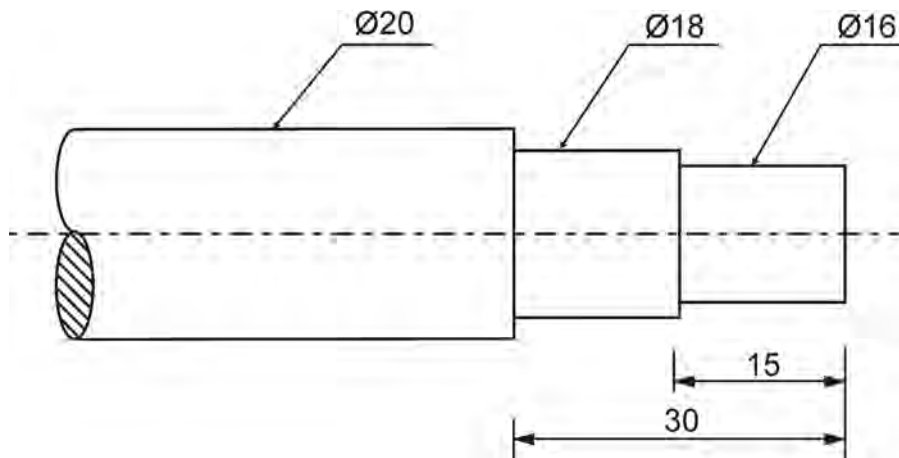
3. During this process, the diameter of the work is checked with the help of outside caliper.

4. Finishing tool is used to obtain accurate dimensions of length and diameter.

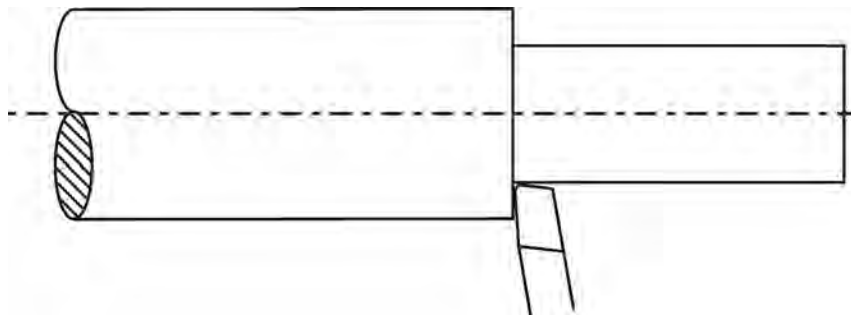
## **Result**

The finished piece of work is sent for inspection after the machining is over.

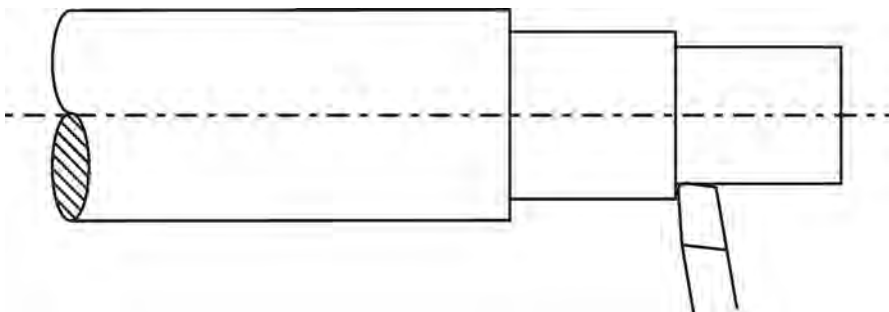
### Exercise - 3 (Step turning)



#### Operation - 1



#### Operation - 2



All dimensions are in mm

## 3. STEP TURNING

### Aim

To perform step turning operation to produce a cylindrical part of given dimensions.

### Required instruments

1. Facing tool
2. Plain turning tool
3. Chuck key
4. Tool holder
5. Steel rule
6. Vernier caliper
7. Outside caliper
8. Inside caliper
9. Surface gauge

### Tool setting

A facing tool and a plain turning tool are mounted on the toolpost and their cutting edges are set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0° mark.

### Holding of the work

1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

### Selection of cutting speed

$$\text{Cutting speed} = \frac{\pi dn}{1,000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.



## **Facing operation**

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

## **Marking**

Marking is done on the work at the required point to indicate the length of the steps to be turned.

## **Procedure**

1. The cross-slide is adjusted for required depth of cut and the lathe is switched on. The plain turning tool mounted on the toolpost is given feed by the carriage parallel to the lathe axis.

2. The above process is repeated until the required diameter is obtained. The length should be equal to the sum of the lengths of larger and smaller diameter.

3. When the larger step of given diameter is obtained, the tool is again fed parallel to the lathe axis to the given length of smaller step. Depth of cut is gradually given by the cross-slide to get the smaller step of required length and diameter.

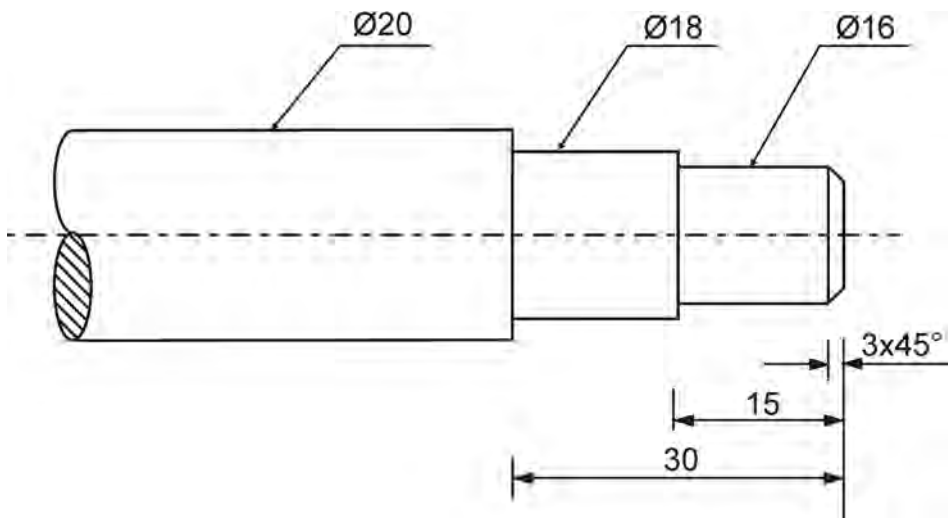
4. Finishing tool is used to obtain accurate dimensions of length and diameter.

5. During this process, the dimensions of the work are checked with the help of outside caliper and inside calipers.

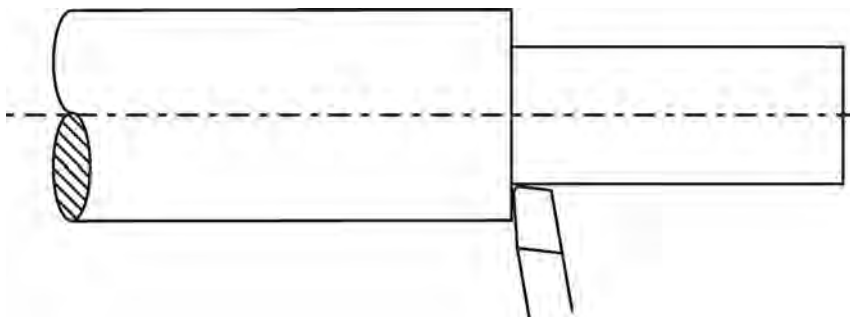
## **Result**

The finished piece of work is sent for inspection after the machining is over.

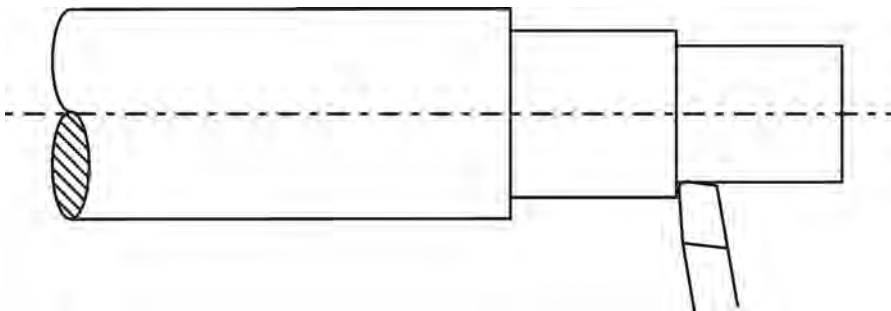
**Exercise - 4 (Step turning and chamfering)**



**Operation - 1**



**Operation - 2**



All dimensions are in mm

## 4. STEP TURNING AND CHAMFERING

### Aim

To perform step turning and chamfering operations to produce a cylindrical part of given dimensions.

### Required instruments

1. Facing tool
2. Plain turning tool
3. Chamfering tool
4. Chuck key
5. Tool holder
6. Steel rule
7. Vernier caliper
8. Outside caliper
9. Inside caliper
10. Surface gauge

### Tool setting

A facing tool, a plain turning tool and a chamfering tool are mounted on the toolpost and their cutting edges are set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0° mark.

### Holding of the work

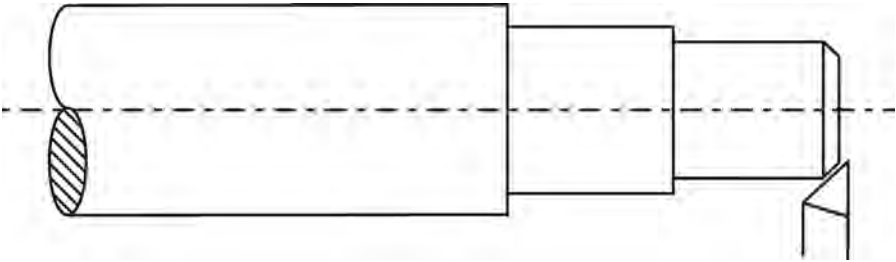
1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

### Selection of cutting speed

$$\text{Cutting speed} = \frac{\pi dn}{1,000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.

**Operation - 3**





## **Facing operation**

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

## **Marking**

Marking is done on the work at the required point to indicate the length of the steps to be turned.

## **Procedure**

1. The cross-slide is adjusted for required depth of cut and the lathe is switched on. The plain turning tool mounted on the toolpost is given feed by the carriage parallel to the lathe axis.

2. The above process is repeated until the given larger diameter is obtained. The length should be equal to the sum of the lengths of larger and smaller diameter. When the larger step of given diameter is obtained, the tool is again fed parallel to the lathe axis to the given length of smaller step. Depth of cut is gradually given by the cross-slide to get the smaller step of required length and diameter.

3. During this process, the dimensions of the work are checked with the help of outside caliper and inside calipers.

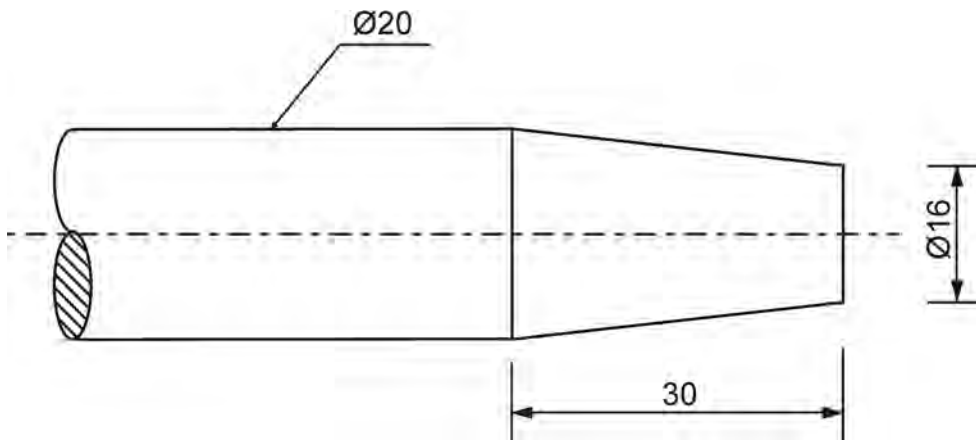
4. Finishing tool is used to obtain accurate dimensions of length and diameter.

5. The chamfering tool (form tool) is set at the end of the work at the required angle. Feed is given to the tool by the cross-slide to perform chamfering.

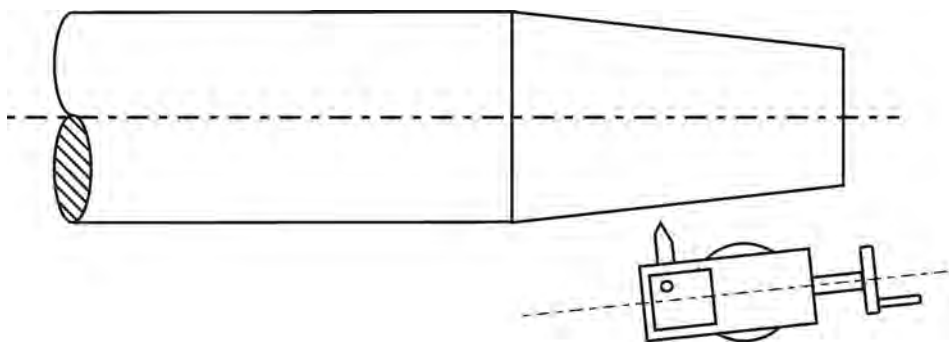
## **Result**

The finished piece of work is sent for inspection after the machining is over.

### Exercise - 5 (Taper turning)



#### Operation - 1



All dimensions are in mm

## 5. TAPER TURNING

### Aim

To perform taper turning to produce a cylindrical part of given dimensions.

### Required instruments

1. Facing tool
2. Plain turning tool
3. Chuck key
4. Tool holder
5. Steel rule
6. Vernier caliper
7. Outside caliper
8. Inside caliper
9. Surface gauge

### Tool setting

A facing tool, and a plain turning tool are mounted on the toolpost and their cutting edges are set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0° mark.

### Holding of the work

1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

### Selection of cutting speed

$$\text{Cutting speed} = \frac{\pi dn}{1,000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.



## Facing operation

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

## Marking

Marking is done on the work at the required point to indicate the length of the steps to be turned.

## Procedure

1. The angle( $\theta$ ) through which the compound slide is to be swiveled is calculated by the formula

$$\tan \theta = \frac{D - d}{2 l}$$

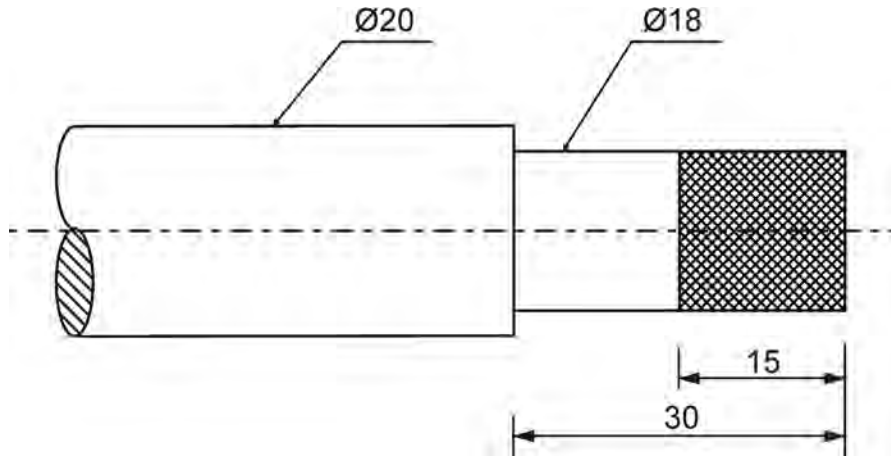
Where 'D' is the larger diameter  
'd' is the smaller diameter and  
'l' is the length of the taper

2. The compound slide is swiveled to the angle calculated as above.
3. The depth of cut is set by adjusting the cross-slide.
4. The plain turning tool mounted on the toolpost is given feed by the compound slide at the required angle to the lathe axis.
5. The above process is repeated until the taper of required length is obtained. This is done by adjusting the cross-slide for depth of cut and compound slide for feed.
6. While doing so, feed is provided from smaller diameter to larger diameter.

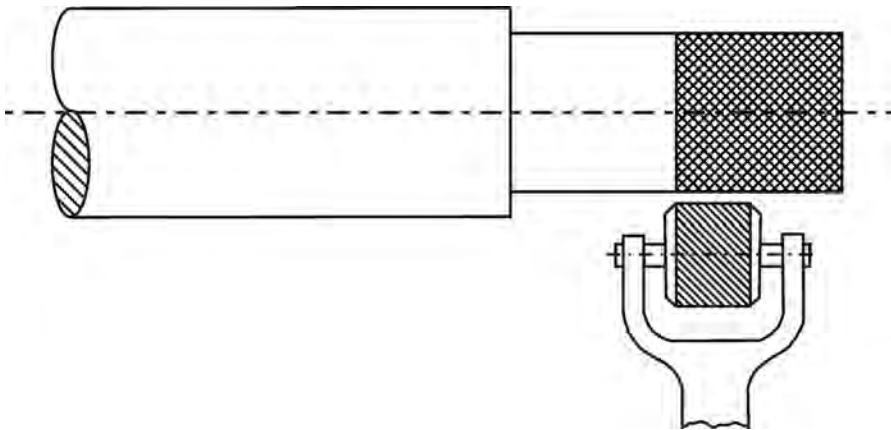
## Result

The finished piece of work is sent for inspection after the machining is over.

### Exercise - 6 (Knurling)



#### Operation - 1



All dimensions are in mm

## 6. KNURLING

### Aim

To perform knurling operation on a cylindrical part of given dimensions.

### Required instruments

1. Facing tool
2. Plain turning tool
3. Knurling tool holder
4. Chuck key
5. Tool holder
6. Steel rule
7. Vernier caliper
8. Outside caliper
9. Inside caliper
10. Surface gauge

### Tool setting

A facing tool and a plain turning tool are mounted on the toolpost and their cutting edges are set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0° mark.

### Holding of the work

1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

### Selection of cutting speed

$$\text{Cutting speed} = \frac{\pi dn}{1,000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.





## **Facing operation**

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

## **Marking**

Marking is done on the work at the required points to indicate the length of the portion to be knurled.

## **Procedure**

1. The cross-slide is adjusted for required depth of cut and the lathe is switched on. The plain turning tool mounted on the toolpost is given feed by the carriage parallel to the lathe axis.

2. The above process is repeated until the required diameter is obtained. This is done by gradually moving the cross-slide after each cut.

3. During this process, the diameter of the work is checked with the help of outside caliper and inside caliper.

4. Finishing tool is used to obtain accurate dimensions of length and diameter.

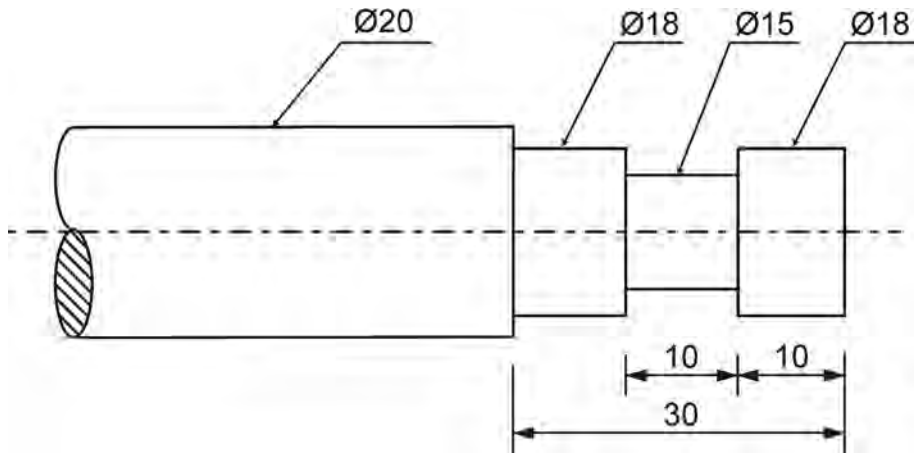
5. A knurling tool holder has one or two knurling rolls fitted to it. It is fitted on the toolpost and pressed against the work rotating at a slower speed. The feed is given by the carriage parallel to the lathe axis.

6. The knurling tool holder is relieved from the work after the operation is performed for the required length.

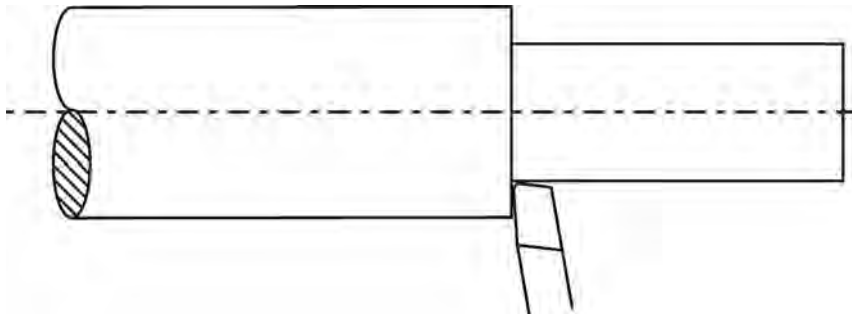
## **Result**

The finished piece of work is sent for inspection after the machining is over.

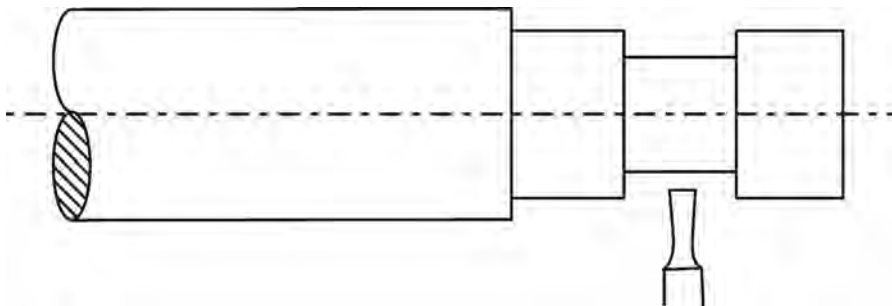
### Exercise - 7 (Grooving)



#### Operation - 1



#### Operation - 2



All dimensions are in mm

## 7. GROOVING

### Aim

To machine a groove of given width and depth on a cylindrical part of given dimensions.

### Required instruments

1. Facing tool
2. Plain turning tool
3. Parting tool
4. Chuck key
5. Tool holder
6. Steel rule
7. Vernier caliper
8. Outside caliper
9. Inside caliper
10. Surface gauge

### Tool setting

A facing tool, a plain turning tool and a parting tool are mounted on the toolpost and their cutting edges are set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0° mark.

### Holding of the work

1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

### Selection of cutting speed

$$\text{Cutting speed} = \frac{\pi dn}{1,000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.



## **Facing operation**

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

## **Marking**

Marking is done on the work at the required points to indicate the location of the groove after plain turning is performed to the required diameter.

## **Procedure**

1. The cross-slide is adjusted for required depth of cut and the lathe is switched on. The plain turning tool mounted on the toolpost is given feed by the carriage parallel to the lathe axis.

2. The above process is repeated until the required diameter is obtained. This is done by gradually moving the cross-slide after each cut.

3. During this process, the diameter of the work is checked with the help of outside caliper and inside caliper.

4. Finishing tool is used to obtain accurate dimensions of length and diameter.

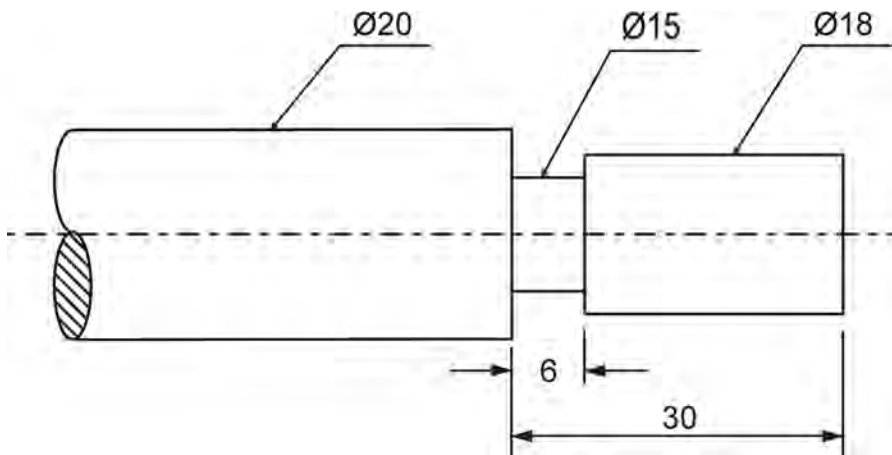
5. The parting tool is brought to the marked location of the groove. The depth of cut is set by the cross-slide and the feed is provided by moving the carriage slowly between the marked points.

6. The above process is repeated until the required depth and the length of the groove is obtained.

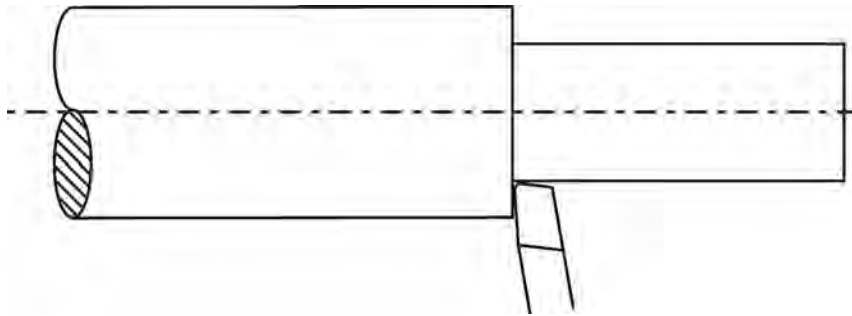
## **Result**

The finished piece of work is sent for inspection after the machining is over.

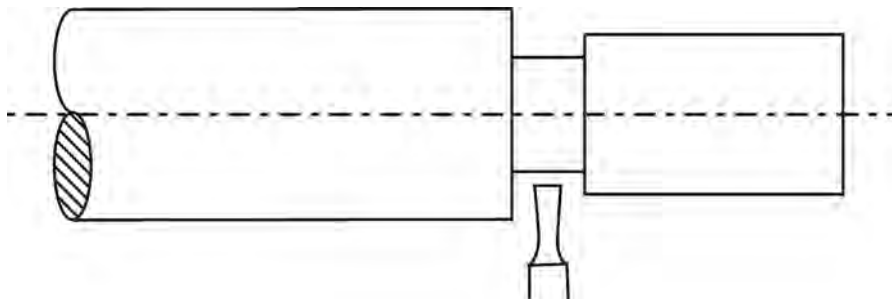
### Exercise - 8 (Undercutting)



#### Operation - 1



#### Operation - 2



All dimensions are in mm

## 8. UNDERCUTTING

### Aim

To machine a undercut groove of given width and depth on a cylindrical part of given dimensions.

### Required instruments

1. Facing tool
2. Plain turning tool
3. Parting tool
4. Chuck key
5. Tool holder
6. Steel rule
7. Vernier caliper
8. Outside caliper
9. Inside caliper
10. Surface gauge

### Tool setting

A facing tool, a plain turning tool and a parting tool are mounted on the toolpost and their cutting edges are set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0° mark.

### Holding of the work

1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

### Selection of cutting speed

$$\text{Cutting speed} = \frac{\pi dn}{1,000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.





## **Facing operation**

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

## **Marking**

Marking is done on the work at the required points to indicate the location of the undercut groove after plain turning is performed to the required diameter.

## **Procedure**

1. The cross-slide is adjusted for required depth of cut and the lathe is switched on. The plain turning tool mounted on the toolpost is given feed by the carriage parallel to the lathe axis.

2. The above process is repeated until the required diameter is obtained. This is done by gradually moving the cross-slide after each cut.

3. During this process, the diameter of the work is checked with the help of outside caliper and inside caliper.

4. Finishing tool is used to obtain accurate dimensions of length and diameter.

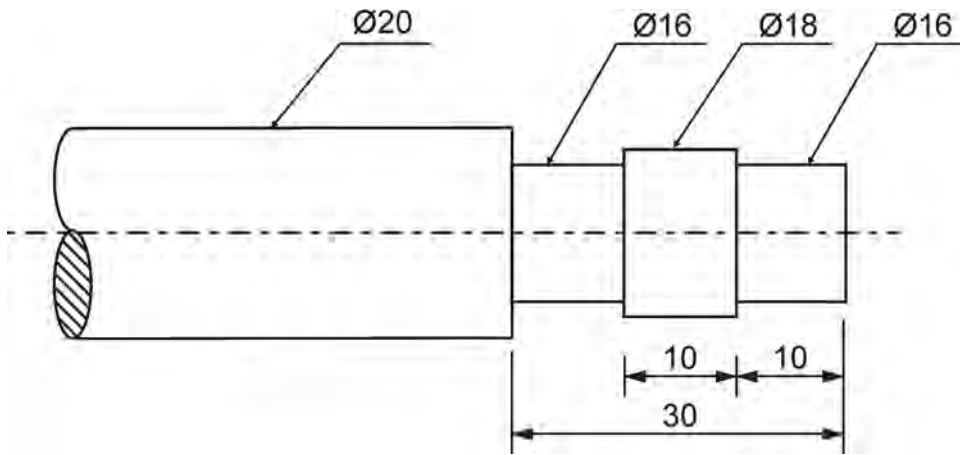
5. The parting tool is brought to the marked location of the groove. The feed is provided by moving the cross-slide slowly into the work perpendicular to the lathe axis.

6. The above process is repeated until the required depth and the length of the groove is obtained.

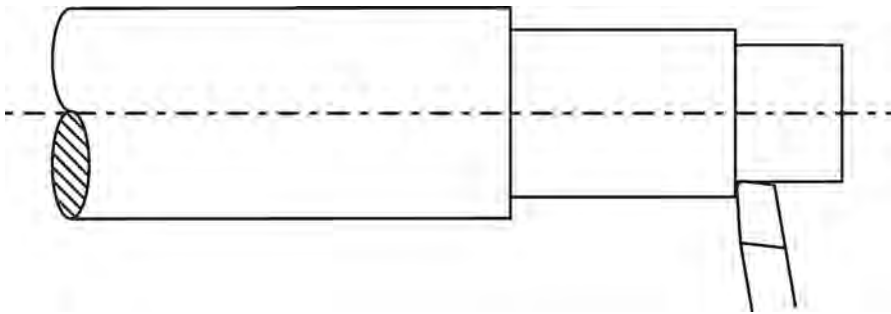
## **Result**

The finished piece of work is sent for inspection after the machining is over.

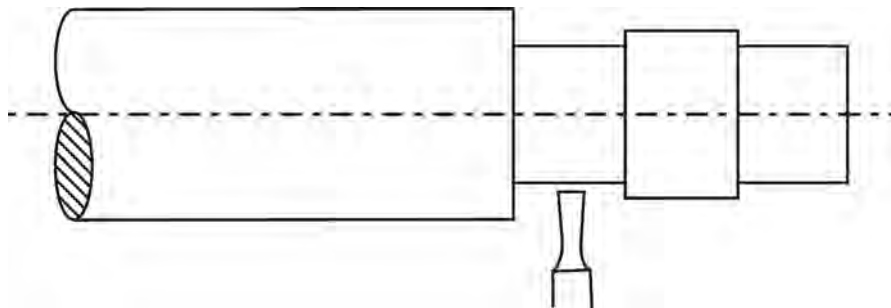
### Exercise - 9 (Collar turning)



#### Operation - 1



#### Operation - 2



All dimensions are in mm

## 9. COLLAR TURNING

### Aim

To machine a collar of given width on a cylindrical part of given dimensions.

### Required instruments

1. Facing tool
2. Plain turning tool
3. Parting tool
4. Chuck key
5. Tool holder
6. Steel rule
7. Vernier caliper
8. Outside caliper
9. Inside caliper
10. Surface gauge

### Tool setting

A facing tool, a plain turning tool and a parting tool are mounted on the toolpost and their cutting edges are set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0° mark.

### Holding of the work

1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

### Selection of cutting speed

$$\text{Cutting speed} = \frac{\pi dn}{1,000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.



## **Facing operation**

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

## **Marking**

Marking is done on the work at the required points to indicate the location of the collar after plain turning is performed to the required diameter.

## **Procedure**

1. The cross-slide is adjusted for required depth of cut and the lathe is switched on. The plain turning tool mounted on the toolpost is given feed to obtain a part of given diameter of the collar.

2. The plain turning tool is used to turn a step at the right side of the collar upto the given length.

3. The above process is repeated until the required diameter is obtained. This is done by gradually moving the cross-slide after each cut.

4. Straight turning is done at the left side of the collar with the help of a parting tool to the given diameter and length.

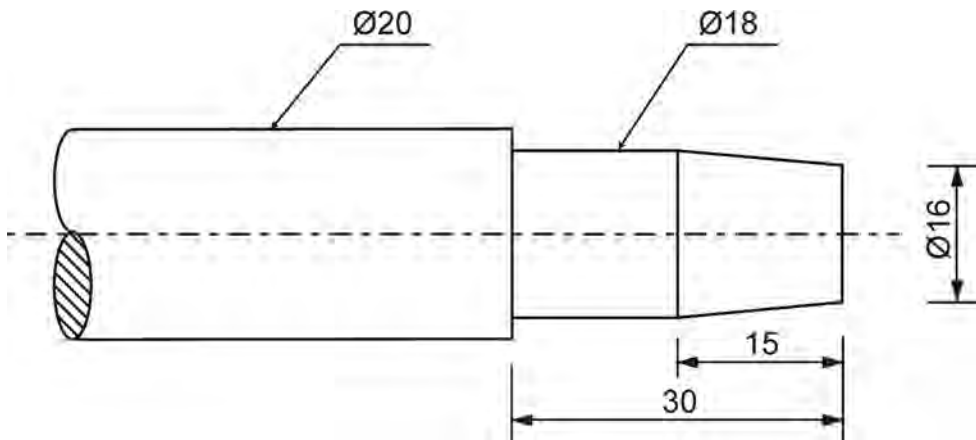
5. During this process, the diameter of the work is checked with the help of outside caliper and inside caliper.

6. Finishing tool is used to obtain accurate dimensions of length and diameter.

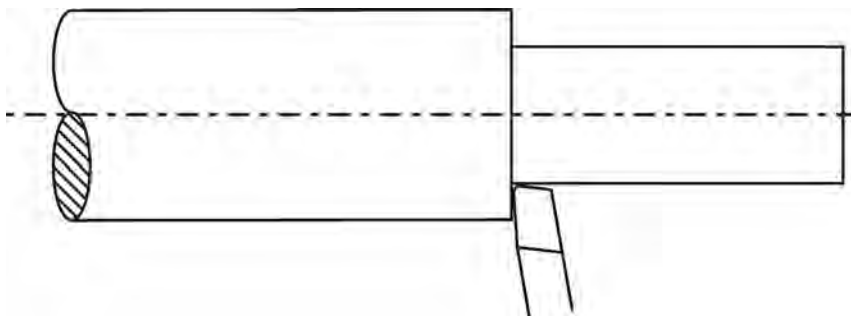
## **Result**

The finished piece of work is sent for inspection after the machining is over.

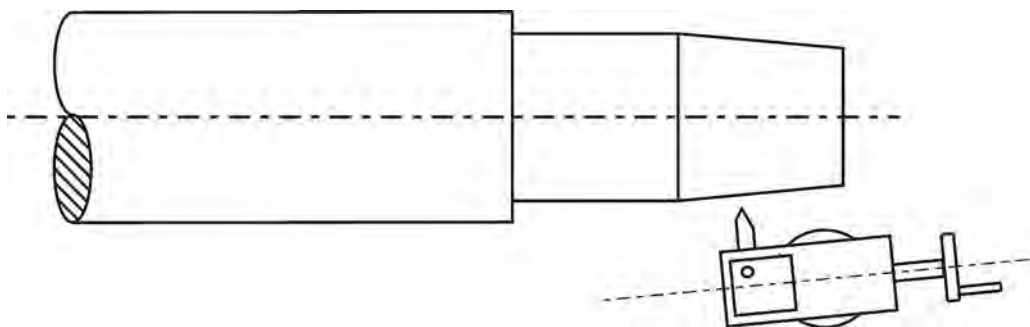
### Exercise - 10 (Plain and taper turning)



#### Operation - 1



#### Operation - 2



All dimensions are in mm

## 10. PLAIN AND TAPER TURNING

### Aim

To perform the operations of plain and taper turning on a cylindrical part of given dimensions.

### Required instruments

1. Facing tool
2. Plain turning tool
3. Chuck key
4. Tool holder
5. Steel rule
6. Vernier caliper
7. Outside caliper
8. Inside caliper
9. Surface gauge

### Tool setting

A facing tool, and a plain turning tool are mounted on the toolpost and their cutting edges are set exactly aligned to the axis of the lathe spindle. The compound rest is set at 0° mark.

### Holding of the work

1. The metal piece to be machined is held in the chuck of the lathe.
2. Surface gauge is used to check whether the work is held aligning with the lathe axis.

### Selection of cutting speed

$$\text{Cutting speed} = \frac{\pi dn}{1,000} \text{ m/min.}$$

The above formula is used to arrive at a proper cutting speed for machining and the spindle speed is adjusted suitably.

## Facing operation

The lathe is switched on and the facing tool mounted on the toolpost is given feed by the cross-slide perpendicular to the lathe axis. A flat surface on the face of the work is generated.

## Marking

Marking is done on the work at the required point to indicate the length to be plain turned.

## Procedure

1. The cross-slide is adjusted for required depth of cut and the lathe is switched on. The plain turning tool mounted on the toolpost is given feed by the carriage parallel to the lathe axis.

2. The above process is repeated until the required diameter is obtained. This is done by gradually moving the cross-slide after each cut.

3. During this process, the diameter of the work is checked with the help of outside caliper.

4. Finishing tool is used to obtain accurate dimensions of length and diameter.

5. The angle( $\theta$ ) through which the compound slide is to be swiveled is calculated by the formula

$$\tan \theta = \frac{D - d}{2 l}$$

Where 'D' is the larger diameter  
'd' is the smaller diameter and  
'l' is the length of the taper

6. After plain turning is done, the compound slide is swiveled to the angle calculated as above. The plain turning tool mounted on the toolpost is given feed by the compound slide at the required angle to the lathe axis. The above process is repeated until the taper of required length is obtained. This is done by adjusting the cross-slide for depth of cut and compound slide for feed. While doing so, feed is provided from smaller diameter to larger diameter.

## Result

The finished piece of work is sent for inspection after the machining is over.



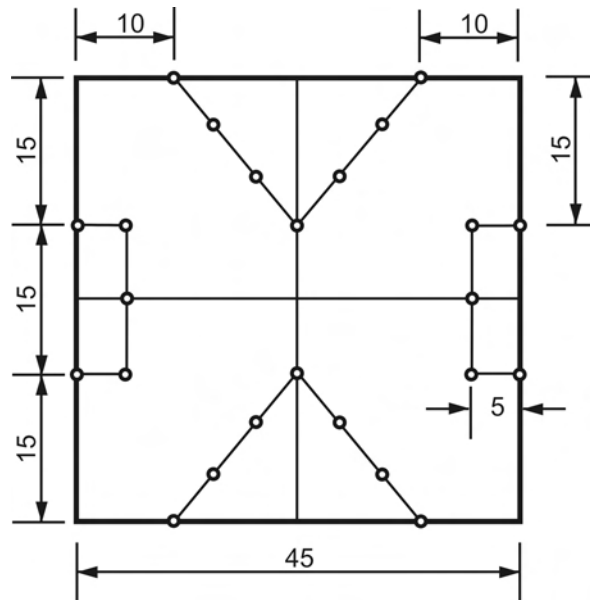
# **GENERAL MACHINIST**

## **PRACTICAL - II**

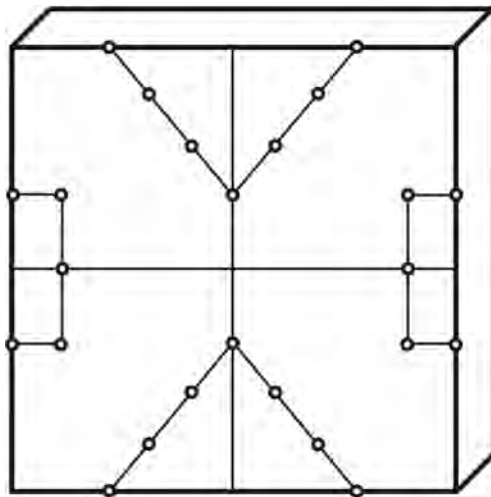
Note : All the dimensions are given in mm. The size of the M.S. flat is given as 50 x 50 x 6.  
The design of the exercises may be modified according to the size of the material available.

## Exercise - 1 (Filing, marking and punching)

### Marking and punching



### Finished model



All dimensions are in mm

# 1. FILING, MARKING & PUNCHING

## **Aim**

To perform the operations of filing, marking and punching

## **Tools required**

1. Bench vise
2. Try square
3. Hacksaw frame
4. Scriber
5. Steel rule
6. Punches
7. Flat file - rough
8. Flat file - medium
9. Flat file - smooth
10. Triangular file
11. Hammer
12. Divider
13. Chalk paste
14. Vernier caliper
15. Surface plate

## **Procedure**

1. The design of the given model is studied completely to understand the features like its size and shape.
2. The given piece of metal is checked for sizes whether it is sufficient for the design.
3. Hand tools and measuring instruments are selected suitably to perform the required operations.
4. The piece of metal (mild steel) is held in the bench vise and two adjacent sides are filed for squareness using a flat file. These two sides are considered prime sides.



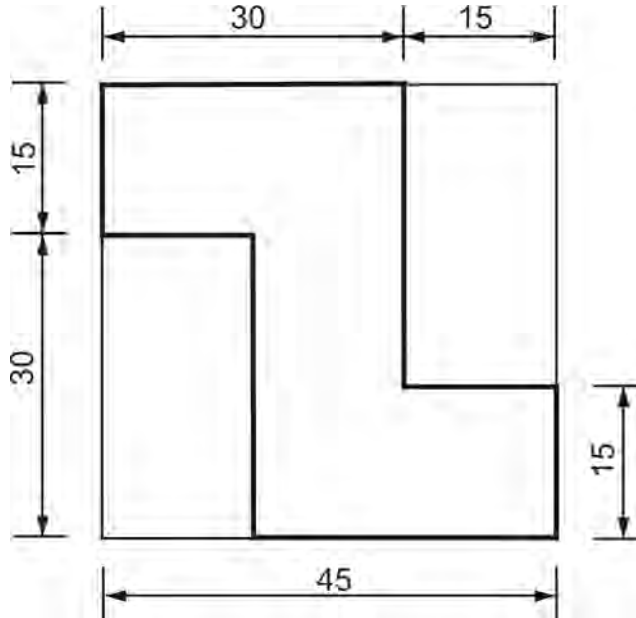
5. The remaining two sides are also filed for squareness (The angle between adjacent sides = 90 degrees). The same is checked with the help of a try-square.
6. The piece of work is checked for 90° on all four sides.
7. A thin layer of chalk paste is applied on the flat surface of the metal piece.
8. Chalk is allowed to dry.
9. The given design is scribed on the chalked surface using steel rule, divider and scriber.
10. Punch marks are made at required points on the surface using a dot punch and a hammer.
11. Punch marks are made by keeping the punch inclined at 60° so that they are filed off later.
12. The spacing between adjacent punch marks should be at least 6mm.

## **Result**

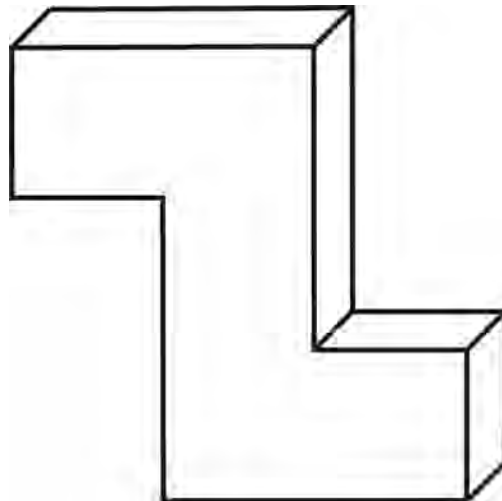
The operations of square filing, marking and punching are performed according to the given design on the given M.S plate.

## Exercise - 2 ('L' cutting)

### Marking and punching



### Finished model



All dimensions are in mm

## 2. 'L' CUTTING

### **Aim**

To make the given shape in given size on the given M.S. plate.

### **Tools required**

1. Bench vise
2. Try square
3. Hacksaw frame
4. Scriber
5. Steel rule
6. Punches
7. Flat file - rough
8. Flat file - medium
9. Flat file - smooth
10. Triangular file
11. Hammer
12. Divider
13. Chalk paste
14. Vernier caliper
15. Surface plate

### **Procedure**

1. The design of the given model is studied completely to understand the features like its size and shape.
2. The given piece of metal is checked for sizes whether it is sufficient for the design.
3. Hand tools and measuring instruments are selected suitably to perform the required operations.
4. The piece of metal (mild steel) is held in the bench vise and two adjacent sides are filed for squareness using a flat file. These two sides are considered prime sides.





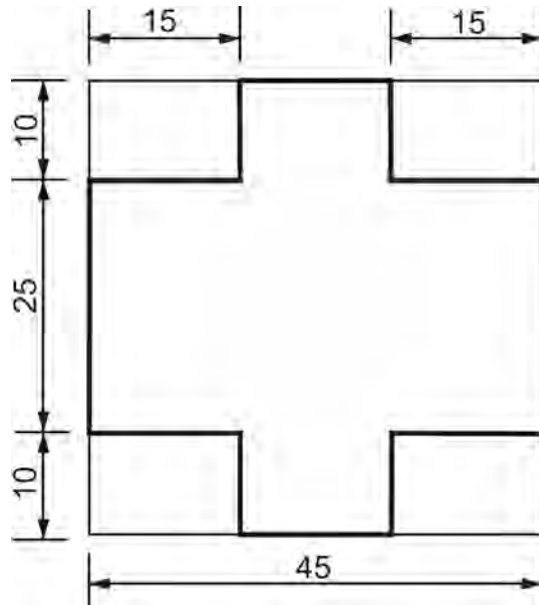
5. The remaining two sides are also filed for squareness (The angle between adjacent sides = 90 degrees). The same is checked with the help of a try-square.
6. The piece of work is checked for 90° on all four sides.
7. A thin layer of chalk paste is applied on the flat surface of the metal piece.
8. Chalk is allowed to dry.
9. Steel rule, divider and scriber are used for scribing.
10. The given design is scribed on the chalked surface by a scriber
11. Punch marks are made at required points on the surface using a dot punch .
12. Punch marks are made by keeping the punch inclined at 60° so that they are filed off later.
13. The spacing between adjacent punch marks should be at least 6mm.
14. Thin auxiliary lines are made at a distance of 1.5mm from the punched line.
15. Hack cuts are made on these auxiliary lines. The unwanted portion of the metal piece is removed.
16. The remaining portion of the metal piece is filed with the help of flat files (rough, medium and smooth)
17. When filing, care is taken that half of the punch mark is retained on the workpiece.
18. The sharp corners of the shape are finish filed with the help of triangular file.
19. The edge surfaces of the workpiece are checked frequently for perpendicularity and parallelism with the help of a try-square.

## **Conclusion**

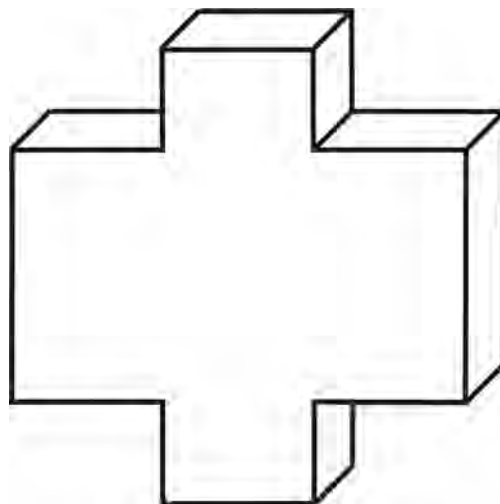
The operations of square filing, marking, punching, hacksaw cutting and finish filing (for 'T' shape) are performed according to the given design on the given M.S plate.

### Exercise - 3 (‘+’ cutting)

#### Marking and punching



#### Finished model



All dimensions are in mm

### 3. '✚' CUTTING

#### **Aim**

To make the given shape in given size on the given M.S. plate.

#### **Tools required**

1. Bench vise
2. Try square
3. Hacksaw frame
4. Scriber
5. Steel rule
6. Punches
7. Flat file - rough
8. Flat file - medium
9. Flat file - smooth
10. Triangular file
11. Hammer
12. Divider
13. Chalk paste
14. Vernier caliper
15. Surface plate

#### **Procedure**

1. The design of the given model is studied completely to understand the features like its size and shape.
2. The given piece of metal is checked for sizes whether it is sufficient for the design.
3. Hand tools and measuring instruments are selected suitably to perform the required operations.
4. The piece of metal (mild steel) is held in the bench vise and two adjacent sides are filed for squareness using a flat file. These two sides are considered prime sides.



5. The remaining two sides are also filed for squareness (The angle between adjacent sides = 90 degrees). The same is checked with the help of a try-square.

6. The piece of work is checked for 90° on all four sides.

7. A thin layer of chalk paste is applied on the flat surface of the metal piece.

8. Chalk is allowed to dry.

9. Steel rule, divider and scriber are used for scribing.

10. The given design is scribed on the chalked surface by a scriber

11. Punch marks are made at required points on the surface using a dot punch .

12. Punch marks are made by keeping the punch inclined at 60° so that they are filed off later.

13. The spacing between adjacent punch marks should be at least 6mm.

14. Thin auxiliary lines are made at a distance of 1.5mm from the punched line.

15. Hack cuts are made on these auxiliary lines. The unwanted portion of the metal piece is removed.

16. The remaining portion of the metal piece is filed with the help of flat files (rough, medium and smooth)

17. When filing, care is taken that half of the punch mark is retained on the workpiece.

18. The sharp corners of the shape are finish filed with the help of triangular file.

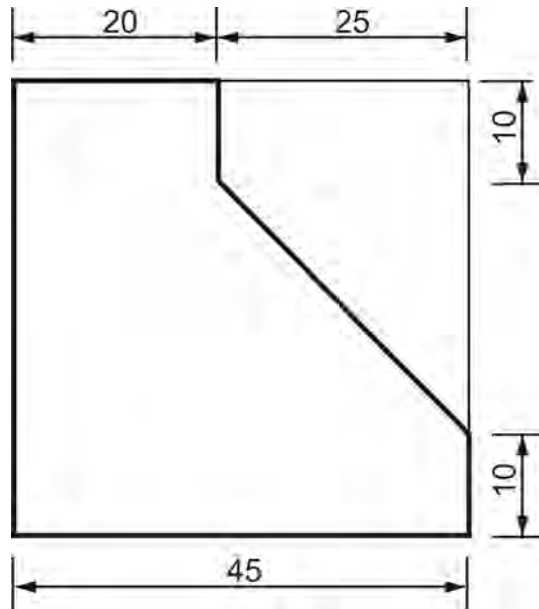
19. The edge surfaces of the workpiece are checked frequently for perpendicularity and parallelism with the help of a try-square.

## **Conclusion**

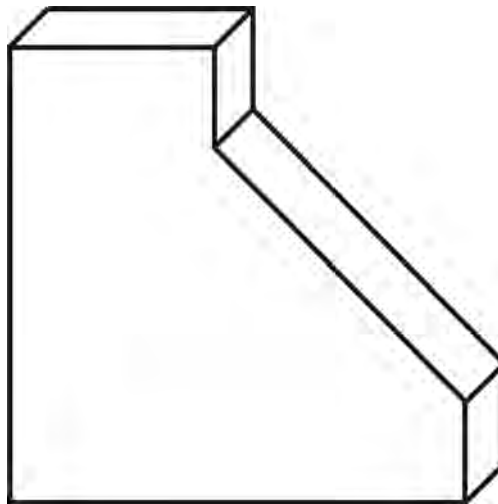
The operations of square filing, marking, punching, hacksaw cutting and finish filing (for 'T' shape) are performed according to the given design on the given M.S plate.

### Exercise - 4 (‘’ cutting)

#### Marking and punching



#### Finished model



All dimensions are in mm

## 4. ' ' CUTTING

### **Aim**

To make the given shape in given size on the given M.S. plate.

### **Tools required**

1. Bench vise
2. Try square
3. Hacksaw frame
4. Scriber
5. Steel rule
6. Punches
7. Flat file - rough
8. Flat file - medium
9. Flat file - smooth
10. Triangular file
11. Hammer
12. Divider
13. Chalk paste
14. Vernier caliper
15. Bevel protractor
16. Protractor
17. Combination set
18. Surface plate

### **Procedure**

1. The design of the given model is studied completely to understand the features like its size and shape.
2. The given piece of metal is checked for sizes whether it is sufficient for the design.
3. Hand tools and measuring instruments are selected suitably to perform the required operations.





4. The piece of metal (mild steel) is held in the bench vise and two adjacent sides are filed for squareness using a flat file. These two sides are considered prime sides.

5. The remaining two sides are also filed for squareness (The angle between adjacent sides = 90 degrees). The same is checked with the help of a try-square.

6. The piece of work is checked for 90° on all four sides.

7. A thin layer of chalk paste is applied on the flat surface of the metal piece.

8. Chalk is allowed to dry.

9. Steel rule, divider and scriber are used for scribing.

10. The given design is scribed on the chalked surface by a scriber. The angular lines are scribed with the help of a protractor head of a combination set.

11. Punch marks are made at required points on the surface using a dot punch .

12. Punch marks are made by keeping the punch inclined at 60° so that they are filed off later.

13. The spacing between adjacent punch marks should be at least 6mm.

14. Thin auxiliary lines are made at a distance of 1.5mm from the punched line.

15. Hack cuts are made on these auxiliary lines. The unwanted portion of the metal piece is removed.

16. The remaining portion of the metal piece is filed with the help of flat files (rough, medium and smooth)

17. When filing, care is taken that half of the punch mark is retained on the workpiece.

18. The sharp corners of the shape are finish filed with the help of triangular file.

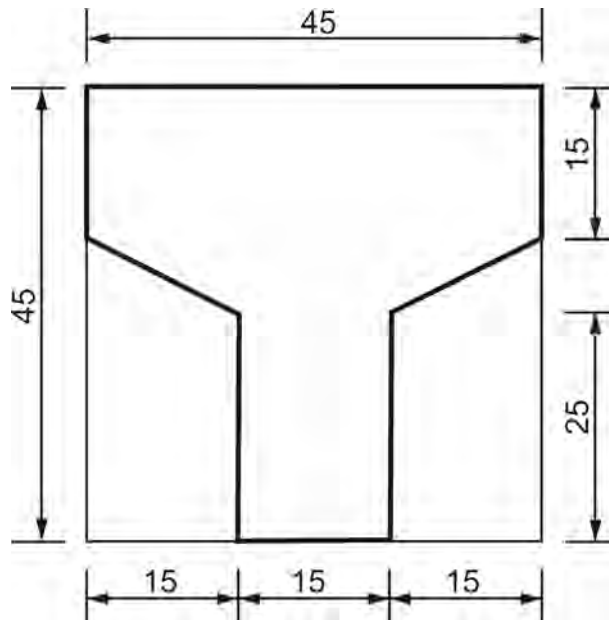
19. The edge surfaces of the workpiece are checked frequently for perpendicularity and parallelism with the help of a try-square.

## **Conclusion**

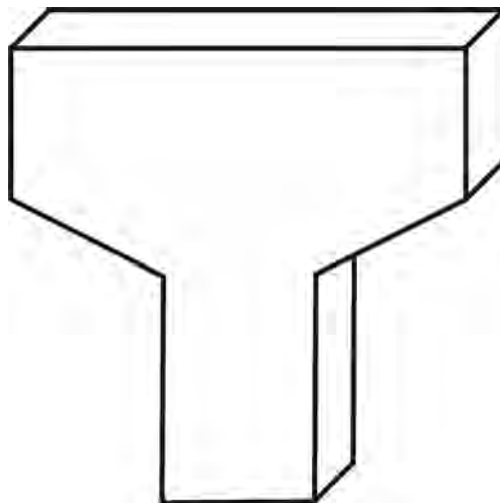
The operations of square filing, marking, punching, hacksaw cutting and finish filing (for 'T' shape) are performed according to the given design on the given M.S plate.

**Exercise - 5 (' cutting)**

**Marking and punching**



**Finished model**



All dimensions are in mm

## 5. 'Y' CUTTING

### **Aim**

To make the given shape in given size on the given M.S. plate.

### **Tools required**

1. Bench vise
2. Try square
3. Hacksaw frame
4. Scriber
5. Steel rule
6. Punches
7. Flat file - rough
8. Flat file - medium
9. Flat file - smooth
10. Triangular file
11. Hammer
12. Divider
13. Chalk paste
14. Vernier caliper
15. Bevel protractor
16. Protractor
17. Combination set
18. Surface plate

### **Procedure**

1. The design of the given model is studied completely to understand the features like its size and shape.
2. The given piece of metal is checked for sizes whether it is sufficient for the design.
3. Hand tools and measuring instruments are selected suitably to perform the required operations.



4. The piece of metal (mild steel) is held in the bench vise and two adjacent sides are filed for squareness using a flat file. These two sides are considered prime sides.

5. The remaining two sides are also filed for squareness (The angle between adjacent sides = 90 degrees). The same is checked with the help of a try-square.

6. The piece of work is checked for 90° on all four sides.

7. A thin layer of chalk paste is applied on the flat surface of the metal piece.

8. Chalk is allowed to dry.

9. Steel rule, divider and scriber are used for scribing.

10. The given design is scribed on the chalked surface by a scriber. The angular lines are scribed with the help of a protractor head of a combination set.

11. Punch marks are made at required points on the surface using a dot punch .

12. Punch marks are made by keeping the punch inclined at 60° so that they are filed off later.

13. The spacing between adjacent punch marks should be at least 6mm.

14. Thin auxiliary lines are made at a distance of 1.5mm from the punched line.

15. Hack cuts are made on these auxiliary lines. The unwanted portion of the metal piece is removed.

16. The remaining portion of the metal piece is filed with the help of flat files (rough, medium and smooth)


17. When filing, care is taken that half of the punch mark is retained on the workpiece.

18. The sharp corners of the shape are finish filed with the help of triangular file.

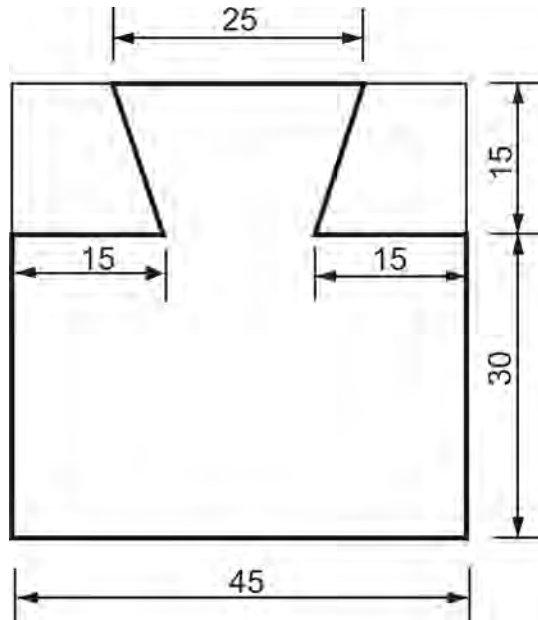
19. The edge surfaces of the workpiece are checked frequently for perpendicularity and parallelism with the help of a try-square.

## **Conclusion**

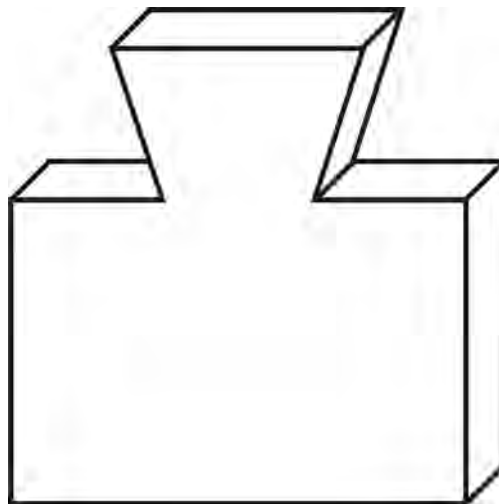
The operations of square filing, marking, punching, hacksaw cutting and finish filing (for 'T' shape) are performed according to the given design on the given M.S plate.

**Exercise - 6 ('' cutting)**

**Marking and punching**



**Finished model**



All dimensions are in mm

## 6. '□' CUTTING

### **Aim**

To make the given shape in given size on the given M.S. plate.

### **Tools required**

1. Bench vise
2. Try square
3. Hacksaw frame
4. Scriber
5. Steel rule
6. Punches
7. Flat file - rough
8. Flat file - medium
9. Flat file - smooth
10. Triangular file
11. Hammer
12. Divider
13. Chalk paste
14. Vernier caliper
15. Bevel protractor
16. Protractor
17. Combination set
18. Surface plate

### **Procedure**

1. The design of the given model is studied completely to understand the features like its size and shape.
2. The given piece of metal is checked for sizes whether it is sufficient for the design.
3. Hand tools and measuring instruments are selected suitably to perform the required operations.





4. The piece of metal (mild steel) is held in the bench vise and two adjacent sides are filed for squareness using a flat file. These two sides are considered prime sides.

5. The remaining two sides are also filed for squareness (The angle between adjacent sides = 90 degrees). The same is checked with the help of a try-square.

6. The piece of work is checked for 90° on all four sides.

7. A thin layer of chalk paste is applied on the flat surface of the metal piece.

8. Chalk is allowed to dry.

9. Steel rule, divider and scriber are used for scribing.

10. The given design is scribed on the chalked surface by a scriber. The angular lines are scribed with the help of a protractor head of a combination set.

11. Punch marks are made at required points on the surface using a dot punch .

12. Punch marks are made by keeping the punch inclined at 60° so that they are filed off later.

13. The spacing between adjacent punch marks should be at least 6mm.

14. Thin auxiliary lines are made at a distance of 1.5mm from the punched line.

15. Hack cuts are made on these auxiliary lines. The unwanted portion of the metal piece is removed.

16. The remaining portion of the metal piece is filed with the help of flat files (rough, medium and smooth)


17. When filing, care is taken that half of the punch mark is retained on the workpiece.

18. The sharp corners of the shape are finish filed with the help of triangular file.

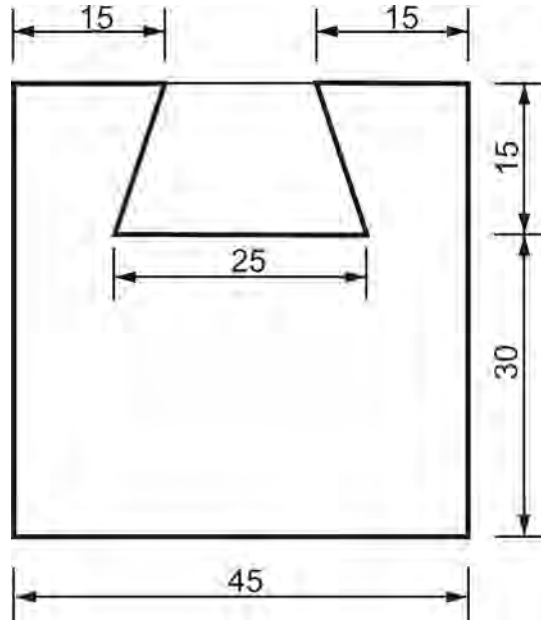
19. The edge surfaces of the workpiece are checked frequently for perpendicularity and parallelism with the help of a try-square.

## **Conclusion**

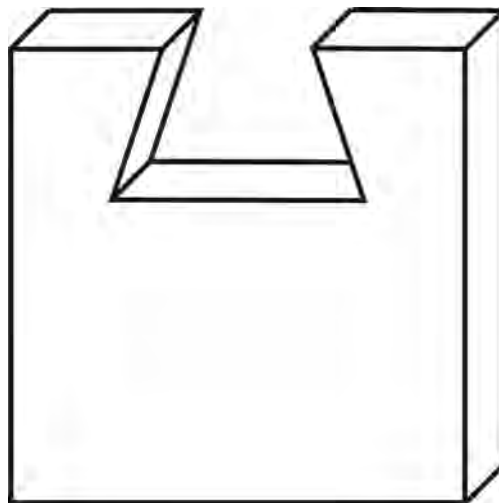
The operations of square filing, marking, punching, hacksaw cutting and finish filing (for 'T' shape) are performed according to the given design on the given M.S plate.

**Exercise - 7 (‘’ cutting)**

**Marking and punching**



**Finished model**



All dimensions are in mm

## 7. '□' CUTTING

### **Aim**

To make the given shape in given size on the given M.S. plate.

### **Tools required**

1. Bench vise
2. Try square
3. Hacksaw frame
4. Scriber
5. Steel rule
6. Punches
7. Flat file - rough
8. Flat file - medium
9. Flat file - smooth
10. Triangular file
11. Hammer
12. Divider
13. Chalk paste
14. Vernier caliper
15. Bevel protractor
16. Protractor
17. Combination set
18. Surface plate

### **Procedure**

1. The design of the given model is studied completely to understand the features like its size and shape.
2. The given piece of metal is checked for sizes whether it is sufficient for the design.
3. Hand tools and measuring instruments are selected suitably to perform the required operations.



4. The piece of metal (mild steel) is held in the bench vise and two adjacent sides are filed for squareness using a flat file. These two sides are considered prime sides.

5. The remaining two sides are also filed for squareness (The angle between adjacent sides = 90 degrees). The same is checked with the help of a try-square.

6. The piece of work is checked for 90° on all four sides.

7. A thin layer of chalk paste is applied on the flat surface of the metal piece.

8. Chalk is allowed to dry.

9. Steel rule, divider and scribe are used for scribing.

10. The given design is scribed on the chalked surface by a scribe. The angular lines are scribed with the help of a protractor head of a combination set.

11. Punch marks are made at required points on the surface using a dot punch .

12. Punch marks are made by keeping the punch inclined at 60° so that they are filed off later.

13. The spacing between adjacent punch marks should be at least 6mm.

14. Thin auxiliary lines are made at a distance of 1.5mm from the punched line.

15. Hack cuts are made on these auxiliary lines. The unwanted portion of the metal piece is removed.

16. The remaining portion of the metal piece is filed with the help of flat files (rough, medium and smooth)

17. When filing, care is taken that half of the punch mark is retained on the workpiece.

18. The sharp corners of the shape are finish filed with the help of triangular file.

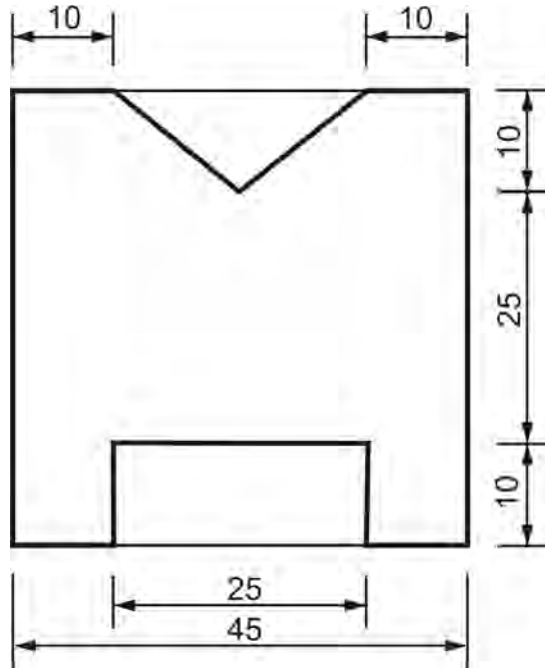
19. The edge surfaces of the workpiece are checked frequently for perpendicularity and parallelism with the help of a try-square.

## **Conclusion**

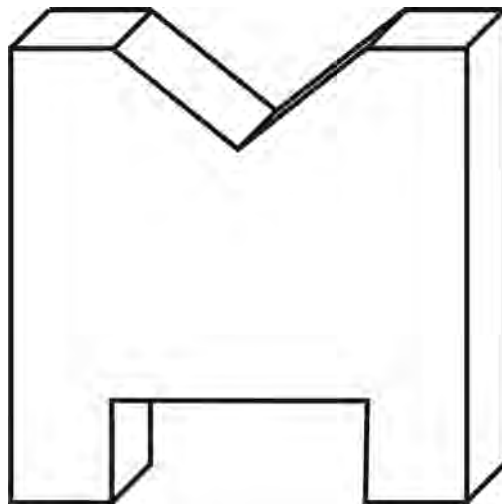
The operations of square filing, marking, punching, hacksaw cutting and finish filing (for 'T' shape) are performed according to the given design on the given M.S plate.

## Exercise - 8 ('M' cutting)

### Marking and punching



### Finished model



All dimensions are in mm

## 8. 'M' CUTTING

### **Aim**

To make the given shape in given size on the given M.S. plate.

### **Tools required**

1. Bench vise
2. Try square
3. Hacksaw frame
4. Scriber
5. Steel rule
6. Punches
7. Flat file - rough
8. Flat file - medium
9. Flat file - smooth
10. Triangular file
11. Hammer
12. Divider
13. Chalk paste
14. Vernier caliper
15. Bevel protractor
16. Protractor
17. Combination set
18. Surface plate

### **Procedure**

1. The design of the given model is studied completely to understand the features like its size and shape.
2. The given piece of metal is checked for sizes whether it is sufficient for the design.
3. Hand tools and measuring instruments are selected suitably to perform the required operations.





4. The piece of metal (mild steel) is held in the bench vise and two adjacent sides are filed for squareness using a flat file. These two sides are considered prime sides.

5. The remaining two sides are also filed for squareness (The angle between adjacent sides = 90 degrees). The same is checked with the help of a try-square.

6. The piece of work is checked for 90° on all four sides.

7. A thin layer of chalk paste is applied on the flat surface of the metal piece.

8. Chalk is allowed to dry.

9. Steel rule, divider and scriber are used for scribing.

10. The given design is scribed on the chalked surface by a scriber. The angular lines are scribed with the help of a protractor head of a combination set.

11. Punch marks are made at required points on the surface using a dot punch .

12. Punch marks are made by keeping the punch inclined at 60° so that they are filed off later.

13. The spacing between adjacent punch marks should be at least 6mm.

14. Thin auxiliary lines are made at a distance of 1.5mm from the punched line.

15. Hack cuts are made on these auxiliary lines. The unwanted portion of the metal piece is removed.

16. The remaining portion of the metal piece is filed with the help of flat files (rough, medium and smooth)

17. When filing, care is taken that half of the punch mark is retained on the workpiece.

18. The sharp corners of the shape are finish filed with the help of triangular file.

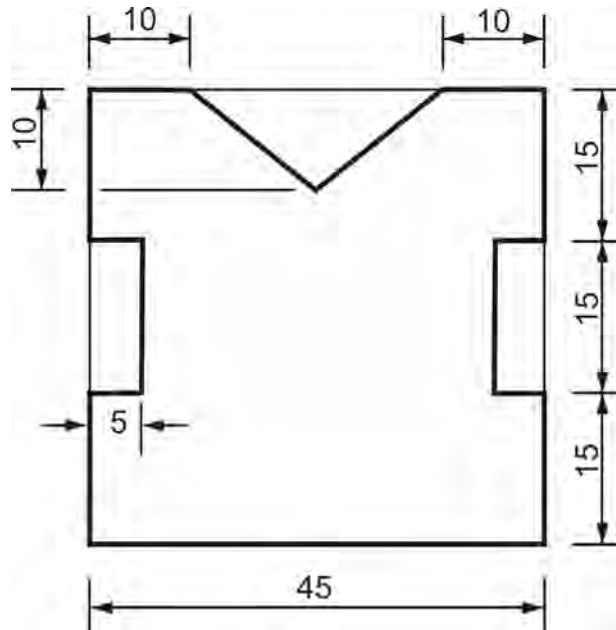
19. The edge surfaces of the workpiece are checked frequently for perpendicularity and parallelism with the help of a try-square.

## **Conclusion**

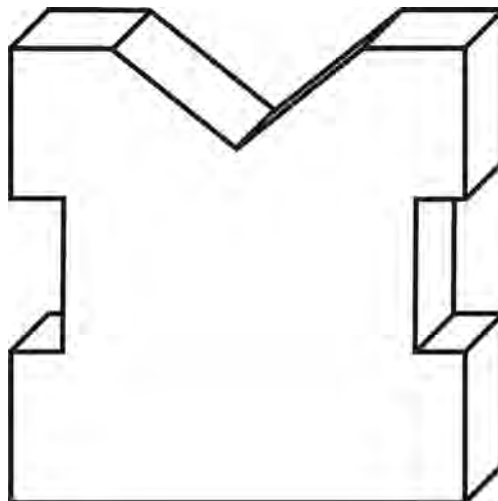
The operations of square filing, marking, punching, hacksaw cutting and finish filing (for 'T' shape) are performed according to the given design on the given M.S plate.

## Exercise - 9 ('M' cutting)

### Marking and punching



### Finished model



All dimensions are in mm

## 9. 'M' CUTTING

### **Aim**

To make the given shape in given size on the given M.S. plate.

### **Tools required**

1. Bench vise
2. Try square
3. Hacksaw frame
4. Scriber
5. Steel rule
6. Punches
7. Flat file - rough
8. Flat file - medium
9. Flat file - smooth
10. Triangular file
11. Hammer
12. Divider
13. Chalk paste
14. Vernier caliper
15. Bevel protractor
16. Protractor
17. Combination set
18. Surface plate

### **Procedure**

1. The design of the given model is studied completely to understand the features like its size and shape.
2. The given piece of metal is checked for sizes whether it is sufficient for the design.
3. Hand tools and measuring instruments are selected suitably to perform the required operations.



4. The piece of metal (mild steel) is held in the bench vise and two adjacent sides are filed for squareness using a flat file. These two sides are considered prime sides.

5. The remaining two sides are also filed for squareness (The angle between adjacent sides = 90 degrees). The same is checked with the help of a try-square.

6. The piece of work is checked for 90° on all four sides.

7. A thin layer of chalk paste is applied on the flat surface of the metal piece.

8. Chalk is allowed to dry.

9. Steel rule, divider and scribe are used for scribing.

10. The given design is scribed on the chalked surface by a scribe. The angular lines are scribed with the help of a protractor head of a combination set.

11. Punch marks are made at required points on the surface using a dot punch .

12. Punch marks are made by keeping the punch inclined at 60° so that they are filed off later.

13. The spacing between adjacent punch marks should be at least 6mm.

14. Thin auxiliary lines are made at a distance of 1.5mm from the punched line.

15. Hack cuts are made on these auxiliary lines. The unwanted portion of the metal piece is removed.

16. The remaining portion of the metal piece is filed with the help of flat files (rough, medium and smooth)


17. When filing, care is taken that half of the punch mark is retained on the workpiece.

18. The sharp corners of the shape are finish filed with the help of triangular file.

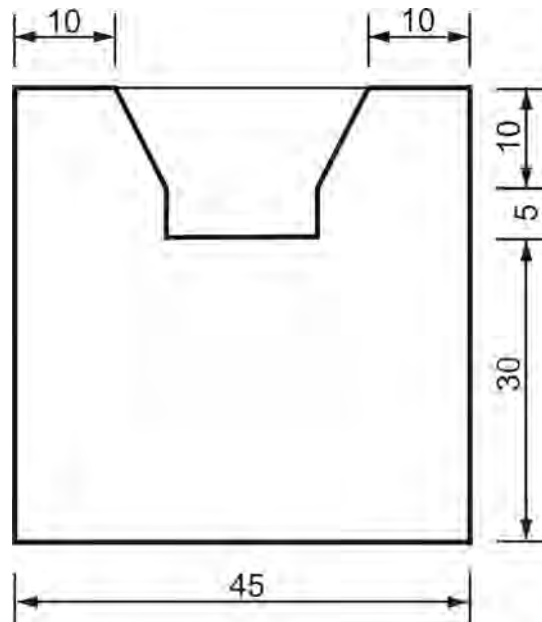
19. The edge surfaces of the workpiece are checked frequently for perpendicularity and parallelism with the help of a try-square.

## **Conclusion**

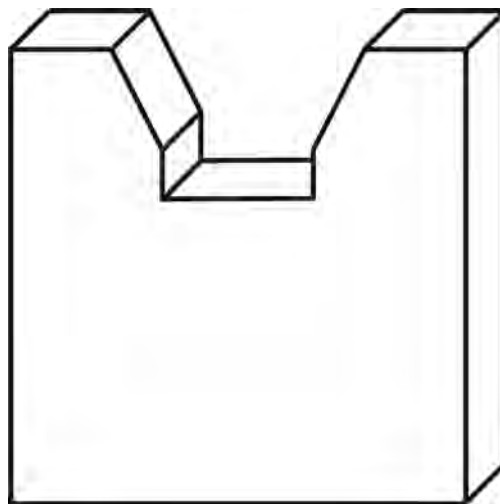
The operations of square filing, marking, punching, hacksaw cutting and finish filing (for 'T' shape) are performed according to the given design on the given M.S plate.

**Exercise - 10** (‘’ cutting)

**Marking and punching**



**Finished model**



All dimensions are in mm

## 10. 'U' CUTTING

### **Aim**

To make the given shape in given size on the given M.S. plate.

### **Tools required**

1. Bench vise
2. Try square
3. Hacksaw frame
4. Scriber
5. Steel rule
6. Punches
7. Flat file - rough
8. Flat file - medium
9. Flat file - smooth
10. Triangular file
11. Hammer
12. Divider
13. Chalk paste
14. Vernier caliper
15. Bevel protractor
16. Protractor
17. Combination set
18. Surface plate

### **Procedure**

1. The design of the given model is studied completely to understand the features like its size and shape.
2. The given piece of metal is checked for sizes whether it is sufficient for the design.
3. Hand tools and measuring instruments are selected suitably to perform the required operations.

4. The piece of metal (mild steel) is held in the bench vise and two adjacent sides are filed for squareness using a flat file. These two sides are considered prime sides.

5. The remaining two sides are also filed for squareness (The angle between adjacent sides = 90 degrees). The same is checked with the help of a try-square.

6. The piece of work is checked for 90° on all four sides.

7. A thin layer of chalk paste is applied on the flat surface of the metal piece.

8. Chalk is allowed to dry.

9. Steel rule, divider and scriber are used for scribing.

10. The given design is scribed on the chalked surface by a scriber. The angular lines are scribed with the help of a protractor head of a combination set.

11. Punch marks are made at required points on the surface using a dot punch .

12. Punch marks are made by keeping the punch inclined at 60° so that they are filed off later.

13. The spacing between adjacent punch marks should be at least 6mm.

14. Thin auxiliary lines are made at a distance of 1.5mm from the punched line.

15. Hack cuts are made on these auxiliary lines. The unwanted portion of the metal piece is removed.

16. The remaining portion of the metal piece is filed with the help of flat files (rough, medium and smooth)

17. When filing, care is taken that half of the punch mark is retained on the workpiece.

18. The sharp corners of the shape are finish filed with the help of triangular file.

19. The edge surfaces of the workpiece are checked frequently for perpendicularity and parallelism with the help of a try-square.

## **Conclusion**

The operations of square filing, marking, punching, hacksaw cutting and finish filing (for 'T' shape) are performed according to the given design on the given M.S plate.