

## LIST OF JOBS

1. To make a layout of workshop and study the tools used in various shops of the workshop.

### Set 1

#### Foundry /Casting Shop

1. To prepare a green sand mould with the help of given single piece pattern
2. To prepare a green sand mould with the help of given split piece pattern.

#### Welding shop

1. To join given MS pieces in Lap and Butt Joint with electric arc welding.
2. To join given MS pieces in T Joint using electric arc welding and to study the Gas Welding Equipment.

#### Sheet Metal Shop

1. To make a hollow cylinder of 63 mm diameter and 80mm height with the help of a seam joint and a locked seam joint
2. To make a rectangular box of 50x40x30 mm size from 28 guage GI sheet.

#### Fitting Shop

1. To cut a mild steel piece from the stock, file it to given the dimensions and make slots using hacksaw as per the markings shown in figure.
2. To cut an appropriate mild steel piece from the stock. Mark it as shown in the figure and cut a square and a quadrant corner using Hacksaw and a round file. Make two 6 mm diameter holes at marked points.

### Set 2

#### Foundry Shop

3. To prepare a green sand mould with the help of single piece pattern(Bearing Cup).

#### Sheet Metal Shop

3. To make a square tapered dustbin with closing edges soldered.

#### Fitting Shop

3. To cut a mild steel piece of appropriate length from the MS stock and make the assembly of male and female parts as per given shape and dimensions.



## Job 1

**AIM:** To make a layout of workshop and study the tools used in various shops of the workshop.

**LHS:** The layout should be drawn as the top view of the workshop showing the worktables, almirahs, machines and other set ups along with teacher's table. The layout (20m x 8m) should be drawn on full page choosing an appropriate scale. Walls, pillars, blackboards, notice boards and display boards are not to be shown. The layout should be properly labeled.

**RHS:** 1) Definition of Plant layout

2) Objectives of Plant Layout.

3) Description of following shops:

a) Foundry shop

b) Welding shop

c) Fitting shop

d) Sheet Metal Shop

4) Name and utility of six tools commonly used in each shop.

### **Viva Voice Question**

(Answers should be brief, to the point and supported by sketches where necessary)

1 What is a layout?

2 What do you understand by utilization of cubic space?

3 What do you understand by manufacturing and manufacturing processes?

4 What are the various types of manufacturing processes?



## Foundry/Casting Shop: Job 1

**AIM:** To prepare a green sand mould with the help of given single piece pattern

**LHS:** Figure and name of 8-10 tools(properly labelled) used in foundry shop.

Figure of Pattern (Front and Top View)

Figure showing the cut section of pattern placed in assembled moulding box with proper foundry terminologies

**Tools used:** Clearly mention the name of all the tools used for preparing the job.

### **Procedure:**

- 1) Mix Silica sand, clay and water uniformly with the help of a shovel to prepare moulding sand.
- 2) Place the drag box upside down on the floor and place the pattern inside it.
- 3) Put moulding sand in it and ram it properly.
- 4) Turn the drag box upside down and place the cope box on it.
- 5) Position the sprue pin and the riser pin properly.
- 6) Fill the moulding sand in cope box and ram it.
- 7) Remove the sprue pin and the riser pin and make cup on the riser hole.
- 8) Remove the cope box and place it by the side of drag box.
- 9) Remove the pattern and cut gates.
- 10) Replace the cope box and complete the mould.

### **Precautions:**

(Clearly mention the five relevant precautions taken during the experiment)

### **Viva Voice questions**

(Answers should be brief, to the point and supported by sketches where necessary)

- 1) Define Pattern and Mould? Name and sketch the various types of Patterns?
- 2) What is the Principle Ingredients of Moulding sand?
- 3) Give the list of different pattern materials.
- 4) What is the difference between a mould and a casting?
- 5) What is a cope box and a drag box? How do you identify them?
- 6) What is effect of excess water in Moulding Sand?
- 7) What are the drawbacks of over-ramming and under-ramming?



## Foundry/Casting Shop: Job 2

**AIM:** To prepare a green sand mould with the help of given split piece pattern

**LHS:** Figure of Pattern (Front and Top View)

Figure showing the cut section of pattern placed in assembled moulding box with proper foundry terminologies

**Tools used:** Clearly mention the name of all the tools used for preparing the job.

### **Procedure:**

- 1) Mix Silica sand, clay and water uniformly with the help of a shovel to prepare moulding sand.
- 2) Place the drag box upside down on the floor and place the pattern inside it.
- 3) Put moulding sand in it and ram it properly.
- 4) Turn the drag box upside down and place the cope box on it.
- 5) Position the sprue pin and the riser pin properly.
- 6) Fill the moulding sand in cope box and ram it.
- 7) Remove the sprue pin and the riser pin and make cup on the riser hole.
- 8) Remove the cope box and place it by the side of drag box.
- 9) Remove the pattern and cut gates.
- 10) Replace the cope box and complete the mould.

### **Precautions:**

(Clearly mention the five relevant precautions taken during the experiment)

### **Viva Voice questions**

(Answers should be brief, to the point and supported by sketches where necessary)

- 1 Name the important properties a moulding sand should possess.
2. What is the difference between Green Sand Mould and Dry Sand Mould?
- 3 What is the purpose of draw spike and vent wire?
- 4 What are pattern allowances? Why these are provided? Name various pattern allowances.
- 5 What is a dowel pin and why it is required in a split pattern?
6. What are core and core prints? Why and where these are provided?
7. Why sprue and riser pins are tapered?



### Foundry/Casting Shop: Job 3

**AIM:** To prepare a green sand mould with the help of single piece pattern (Bearing Cap).

**LAIS:** Figure of Pattern (Front and Top View)

Figure showing cut section of pattern placed in assembled moulding box with proper foundry terminologies

**Tools used:** Clearly mention the name of all the tools used for preparing the job.

#### **Procedure:**

- 1) Mix Silica, clay and water uniformly with the help of a shovel to prepare moulding sand.
- 2) Place the drag box upside down on the floor and place the pattern inside it.
- 3) Put moulding sand in it and ram it properly.
- 4) Turn the moulding drag box upside down
- 5) Remove the sand present in the pattern, if any. Fill the bearing cap with Moulding Sand along with reinforcing pins.
- 6) Place the cope box on the drag box
- 7) Position the sprue pin and the riser pin properly.
- 8) Fill the moulding sand in cope box and ram it.
- 9) Remove the sprue pins and riser pin and make the pouring cup on the riser hole/passage.
- 10) Remove the cope box and place it by the side of drag box.
- 11) Remove the pattern and cut gates.
- 12) Replace the cope box and complete the mould.

#### **Precautions:**

(Clearly Mention the five relevant precautions taken during the experiment )

#### **Viva questions**

(Answers should be brief, to the point and supported by sketches where necessary)

- 1) List the functions of a riser in moulds.
- 2) What are the main limitations of sand casting?
- 3) Define refractoriness, strength, permeability and collapsibility w.r.t moulding sand.
- 4) Define permanent die casting and give its applications.
- 5) Name common types of defects in castings.
- 6) What is investment casting? Clearly mention its advantages and disadvantages.
- 7) What is directional solidification of a casting?



## Welding Shop: Job 1

**AIM:** To join given MS pieces in Lap and Butt Joint with Electric Arc Welding

**Material used:** Three M.S. Strips (clearly mention size of strip), Electrode.

**Tools used:** Clearly mention the names of all the tools used for preparing the job.

**LHS :** Figures and names of 8-10 tools (properly labelled) used in Welding Shop.

Dimensioned Figure of welded job (Top, Front and Side View)

### **Procedure**

1) Hold the electrode in the electrode holder and connect the latter to the negative terminal and workpiece to the positive terminal.

2) Switch on the machine

3) Touch the electrode on the rough surface of the welding table and ensure proper arc build up.

4) Clean the two pieces to be joined and place them side-by-side.

5) Do tack welding at the ends of two pieces to ensure proper alignment

6) Now do the welding over the entire length.

7) Remove the slag and clean the joint using a chipping hammer and wire brush

8) Repeat the same procedure for the other side also.

### **Precautions:**

(Clearly mention the five relevant precautions taken during the experiment)

### **Viva Voice questions**

(Answers should be brief, to the point and supported by sketches where necessary)

1 Define welding.

2 What is the principle of Arc welding? How much gap is desired during arc welding?

3 How is slag removed in arc welding?

4 What is tack welding?

5 What is the current and voltage range on which usually an arc-welding machine works and how much current and voltage was used for the job?

6. Name different polarities used in DC arc welding. Give their applications.

7. What are step up and step down transformers?

↓  
Straight polarity - In this, electrode negative  
and the workpiece positive  
Reverse - Reverse of straight



## Welding Shop: Job 2

**AIM:** To join given MS pieces in T Joint using Electric Arc Welding and to study the Gas Welding Equipment.

**Material used:** Three M.S. Strips (Clearly mention size of the strip), Electrode.

**Tools used:** Clearly mention the name of all the tools used for preparing the job.

**LHS :** Dimensioned Figure of welded job (Front, Top and Side View)

Figure of Gas Welding Setup.

### **Procedure:**

- 1) Hold the electrode in the electrode holder and connect the latter to the negative terminal and work piece to the positive terminal.
- 2) Switch on the machine
- 3) Touch the electrode on the rough surface of the welding table and ensure proper arc build up.
- 4) Clean the two pieces to be joined and place them side by side.
- 5) Do tack welding at the ends of two pieces to ensure proper alignment
- 6) Now do the welding over the entire length as per the given dimension..
- 7) Remove the slag and clean the joint using a clipping hammer and wire brush
- 8) Repeat the same procedure for the other side also.

### **Precautions:**

(Clearly mention the five relevant precautions taken during the experiment)

### **Viva Voice question**

(Answers should be brief, to the point and supported by sketches where necessary.)

1. What are the welding defects?
2. Name the gases used in Gas welding process.
3. Explain different types of flames used in Gas welding with help of suitable diagrams.
4. What are the functions of flux in Gas welding? Name the brands of flux used.
5. What is the carbon content in Mild steel, medium and high carbon steel and cast iron.
6. Define forward and backward welding.
7. Briefly explain the equipment, principle, procedure and applications of Gas Welding Process.



## Sheet Metal Shop: Job 1

**AIM:** To make a hollow cylinder of 63 mm diameter and height 80mm with the help of a seam joint and a locked seam joint.

**L.H.S. Figures and name** of 2-10 tools (properly labeled) used in sheet metal shop.

Fig. of two separate GI sheet pieces to be locked.

Figure of final job (top and front view).

**Material used :** Size, gauge and material of the sheet to be specified by the student.

**Tools used:** Clearly mention the names of all the tools used for preparing the job.

**Procedure:**

1. Cut two pieces of 114x80 mm size from the given GI sheet.
2. Make a marking of 6 mm margin on one side of each piece.
3. Bend the sheets on these markings using a rail stake and a mallet, first in a V bend and then in a U bend.
4. Interlock the two bends and press them using a mallet assuring straightness of the lock to get a locked seam joint.
5. Make a marking of 6 mm margin on both sides of the joined piece.
6. Bend the margins again in U bends.
7. Bend the piece in a round shape on the pipe stake.
8. Lock the bends to get a cylinder.

**PRECAUTIONS:**

(Clearly mention the five relevant precautions taken during the experiment)

**Viva Voice questions**

(Answers should be brief, to the point and supported by sketches where necessary)

1. What is GI sheet?
2. What is the difference between hem and seam?
3. How is thickness of a metal sheet specified and explain the term clearly.
4. Name the sheet metal operations used for making the hollow cylindrical job.
5. What is a Steel Square?
6. What is the difference between a seam joint and a locked seam joint.



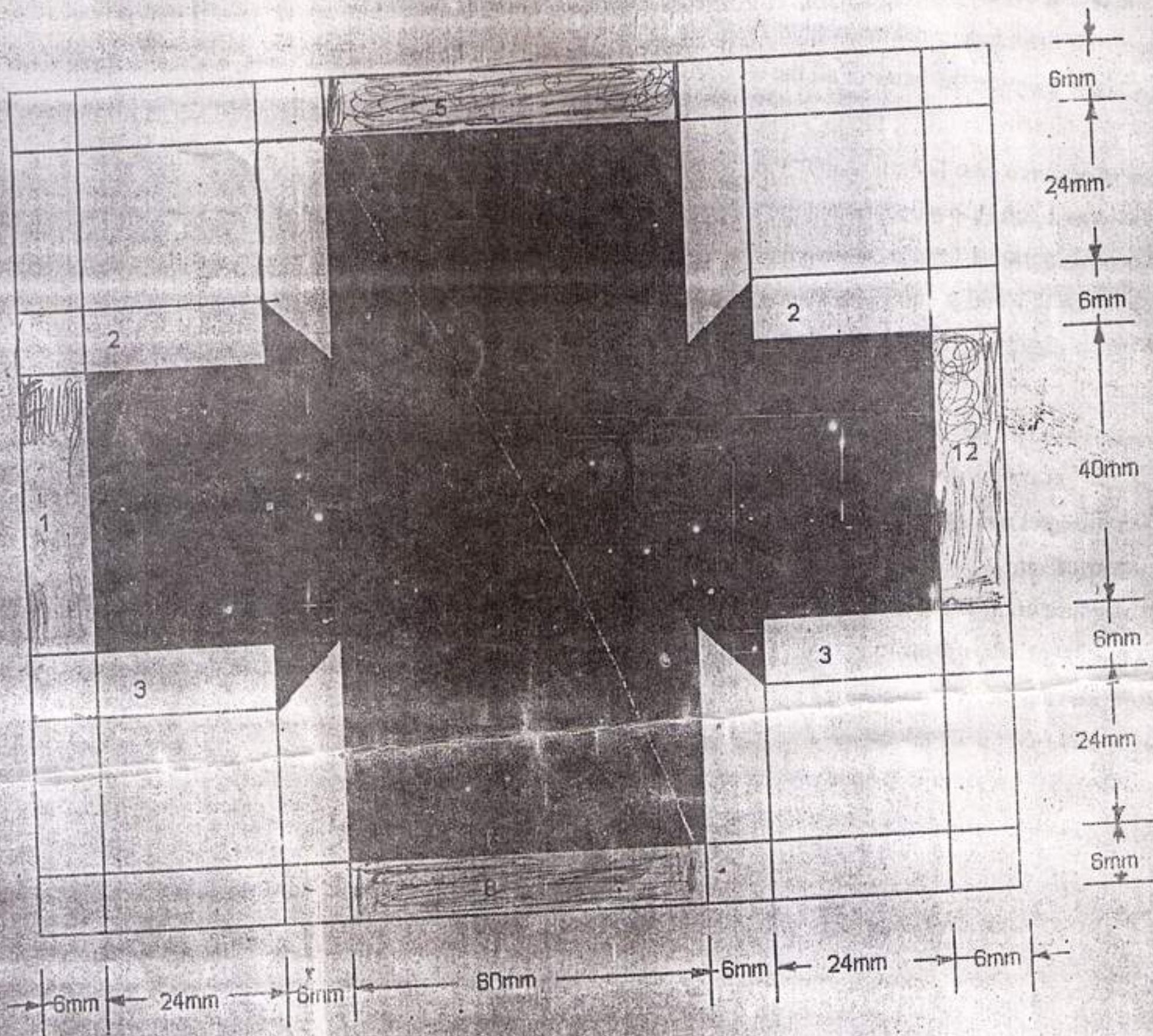


Figure:- Sheet Metal Shop (Job 2)



## Sheet Metal Shop: Job 2

**Aim :** To make a rectangular box of 50x40x30 mm size from 28 guage GI sheet.

**LHS:** Paste the layout of rectangular box.

**Material required:** Size, guage and material of the sheet to be specified by the student.

**Tools used:** Clearly mention the name of all the tools used for preparing the job.

### **Procedure:**

1. Cut a piece of required size 122 x 112 mm and mark it as shown in the diagram.
2. Turn the portions 1,5,8,12 outwards around the corresponding marked line
3. Turn the portions 2,3,9,11 inwards around the corresponding marked lines
4. Completely press portions 1 and 12 outwards.
5. Interlock 2 & 9 with 5 and 3 & 11 with 8 and completely press it.

### **Precautions:**

(Clearly mention the five relevant precautions taken during the experiment)

### **Viva Voice question**

(Answers should be brief, to the point and supported by sketches where neccesary)

- 1 What are the different types of stakes?
- 2 What are the measuring tools used in a sheet metal shop?
- 3 What are the stages in the process of shearing?
- 4 Name four marking tools, four cutting tools, four striking tools and four supporting tools in sheet metal shop.
- 5 What is the difference between blanking , punching and piercing?
6. What are drawing and deep drawing operations?
7. Why we use mallet in sheet metal work instead of hammer?



## Sheet Metal Shop: Job 3

**AIM:** To make a square tapered dustbin with closing edges soldered.

**LHS:** Paste the layout of square tapered dustbin.

**Material required:** Size, gauge and material of the sheet to be specified by the student.

**Tools used:** Clearly mention the name of all the tools used for preparing the job.

### **Procedure:**

1. Cut a piece of required size 170 x 170 mm.
2. Make a small indentation mark using a punch and a hammer in one of the corners of the sheet for placing the divider.
3. Draw circular arcs with indentation marks as centre at a radii of 85 and 167 mm.
4. On outer arc mark four successive arcs of length 60mm and last one of length 5 mm.
5. On inner arc mark four successive arcs of length 30mm and last one of length 5 mm.
6. Join corresponding points on inner and outer arcs with marker
7. Cut the sheet along individual markings on inner and outer circles
8. The final cut piece will look like as in figure.
9. From the remaining portion mark a square piece of 42x42 mm size and cut it as shown in the figure.
10. Bend the edges of the cut square piece at 90° along the marked line inwards.
11. Also bend the top portion of the dustbin along the marked lines joining inner and outer arcs inwards.
12. Solder the closing edge of this top portion using soldering iron.
13. Solder the square base with the top portion.

### **Precautions:**

(Clearly Mention the five relevant precautions taken during the experiment)

### **Viva Voice question**

(Answers should be brief, to the point and supported by sketches where necessary)

- 1 Sketch different types of seams?
- 2 What are the different types of snips?
- 3 What are the different flux materials used in soldering?
- 4 What are the differences between soldering and Gas welding?
- 5 What are the differences between soldering and brazing?
- 6 What are 'Trammels'?



## Fitting Shop: Job 1

**AIM:** To cut a mild steel piece from the stock, file it to the given dimensions and make parallel saw cuts using hacksaw.

**LHS :** Figure and name of 8-10 tools (properly labeled) used in fitting shop.

Draw the dimensioned figure of final job. (Top, Front and Side View)

**Material required:** MS flat of 5mm thickness and 50 mm width.

**Tools used:** Clearly mention the name of all the tools used for preparing the job.

### **Procedure**

1. Cut roughly 1 mm bigger size piece from the stock
2. File it to the size 65x48 assuring perpendicularity of the adjacent edges using appropriate file and a Try square.
3. Mark the job as per given dimensions.
4. Place the blade in the Hacksaw assuring teeth of the blades pointing in the forward direction and tighten the blade.
5. Hold the job in vice firmly and make saw cuts as per marking done.

### **Precautions:**

(Clearly mention the five relevant precautions taken during the experiment)

### **Viva Voice question**

(Answers should be brief, to the point and supported by sketches where necessary)

1. What do you understand by fitting?
2. Why fitting shop is important in modern era of mechanization?
3. What is Mild Steel?
3. What are different methods of filing the job?
4. What are various parts of a bench vice?
5. What are the different types of files?
6. Clearly give purpose of surface plate and V block while marking the job.



## Fitting Shop: Job 2

**AIM:** To cut an appropriate length, mild steel piece from the stock and make the fitting job as per given shape and dimensions.

**Material required:** A flat stock of 5 mm thickness and 50 mm width of mild steel.

**LHS :** Draw the figure of final desired job.(Front, Top and side View).

**Tools used:** Clearly mention the name of all the tools used for preparing the job.

### **Procedure**

1. Cut roughly 1 mm bigger size of piece from the stock.
2. File it to the size 65x48 assuring perpendicularity of the two adjacent edges using appropriate file and a Try square.
3. Mark the job as per given dimensions.
4. Place the blade in the Hacksaw assuring teeth of the blades pointing in the forward direction and tighten the blade.
5. Hold the job in vice firmly and make saw cuts as per marking done.
6. Hold the edge of the square corner perpendicular to the vice and slit it to the required depth.
7. Hold the other edge perpendicular to the vice and slit till it matches the first slit.
8. File the cut surfaces and make surface smooth.
9. Join the circular quadrant corners with the chord and cut this corner along the chord line keeping it perpendicular to the holding edge.
10. Using round file make the roundness of the quadrant as per the markings.
11. Mark center at the points where drilling is to be done.
12. Hold the job in the machine vice and drill hole at desired places.
13. Hold the job flat in the vice and do tapping operation using tap holder and tap set.

**Precautions:** (Clearly mention the five relevant precautions taken during the experiment)

### **Viva Voice question**

(Answers should be brief, to the point and supported by sketches where necessary)

1. What is chipping? Give neat sketch of flat chisel.
2. What is the difference between prick punch and center punch?
3. What is 'setting of teeth' in hacksaw? Why it is done?
4. Sketch different types of hammers used in bench working and fitting work.
5. What are the three different types of taps used in hand tapping?
6. Tell the method to check the trueness of Try square.
7. Name different clamping tools, measuring and marking tool, cutting tools, striking tool, drilling tool and threading tools used in fitting shop.



### Fitting Shop: Job 3

**AIM:** To cut a mild steel piece of appropriate length from the MS stock and make the assembly of male female parts as per given shape and dimensions.

**Material required:** A flat stock of 5 mm thickness and 50 mm width of mild steel.

**LHS :** Draw the figure of final desired job.(top , front and side view)

#### **Procedure:**

1. Cut roughly 1mm bigger size piece from the stock.
2. Cut the bigger pieces into two part viz Part A (male part) and Part B(Female Part)
3. File Part A assuring perpendicularity and flatness of the two adjacent edges using appropriate file and a Try square.
4. Mark the job as per given dimensions.
5. Place the blade in the Hacksaw assuring teeth of the blades pointing in the forward direction and tighten the blade.
6. Hold the edge of the square corner perpendicular to the vice and slit it to the required depth.
7. Hold the other edge perpendicular to the vice and slit till it matches the first slit.
8. File the cut surfaces and make surface smooth.
9. Cut part A as per the given dimensions.
10. Repeat above steps for Part B.
11. Check that part A and B fits properly into part B.

#### **Precautions:**

(Clearly mention the five relevant precautions taken during the experiment)

#### **Viva Questions**

(Answers should be brief, to the point and supported by sketches where necessary)

1. Give different types of vices.
2. What is die and why it is used?
3. What is material of drill and what is its important properties?
4. Name different types of calipers and their respective functions.
5. Define Counter Boring and Counter Sinking operations.
6. Why wing nut is provided on hacksaw?
7. Why helical grooves are provided in the drill?