

**LAB MANUAL**  
**WORKSHOP PRACTICE LAB**  
**ES-164**



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## **IMPORTANT INSTRUCTIONS:**

1. Use hard bound practical notebook containing minimum 200 pages, with *left side blank and right side ruled* and containing index page.
2. Cover the notebook with white thick paper & write your class roll number e.g. A-4; H-15; etc. and your name in block capitals on the top right hand corner.
3. Write the aim (in full), page no., date of performance and date of submission etc. on the index page.
4. Write the *date of performance, aim, materials used, tools used, procedure, precautions and answers to the given viva voice questions* for each job in your workshop file as per instructions in workshop practice manual.
5. Draw all the sketches or figures with pencil and on LHS in your notebook.
6. Follow the *first angle projection* while drawing the three views. Assume the finished job placed in its usual, normal and stable position (choosing front view showing maximum details).
7. Write the procedure in the *third person passive voice*.
8. Get your experiment/job checked & graded on the next /following turn. Failing to do so may lead to reduced marks awarded to you.
9. *Don't write the experiment/job in the workshop notebook which was not performed by you on that day you when were absent.*
10. *Photography Videography* of any tools/ machines/ equipment or operation being performed *is not allowed*.
11. Read beforehand, the experiment/job to be performed next week.
12. To ensure your safety in workshop, you must wear full sleeves shirt/top, full trousers / pants and full shoes. *Don't wear loose clothes, chappals /sandils.*

## **LIST OF JOBS/ EXPERIMENTS**

### **WORKSHOP PRACTICE LAB**

**ES-164**

#### **SET-I**

##### **Fitting Shop**

Job-1. To prepare a job as per given shape and dimensions.

##### **Welding Shop**

Job-2. To demonstrate and study the arc welding equipment and to prepare a Lap Joint & a Butt Joint using electric arc welding process

##### **Sheet Metal Shop**

Job-3. To make a rectangular tray as per given shape and dimensions.

##### **Foundry Shop**

Job-4. To prepare a green sand mould with the help of given single piece pattern (gear blank)

#### **SET-II**

##### **Fitting Shop**

Job-5. To prepare a V-slot as per given shape and dimensions.

##### **Welding Shop**

Job-6. To demonstrate and study the gas welding equipment and to prepare a T- Joint using electric arc welding process.

##### **Sheet Metal Shop**

Job-7. To make a funnel as per given shape and dimensions.

##### **Foundry Shop**

Job-8. To make a green sand mould using a two piece pattern (screw jack body)

## **Workshop Practice Lab (ES-164)**

### **Beyond Curricula**

#### **Fitting Shop**

Job-9. To prepare a V-Fitting as per given shape and dimensions.

#### **Welding Shop**

Job-10. To study the MIG welding equipment and to prepare a Lap Joint using the spot welding process

#### **Sheet Metal Shop**

Job-11. To make a square mug as per given dimensions.

#### **Foundry Shop**

Job-12. To prepare a green sand mould with the help of a single piece pattern (bearing cap)

## **FITTING SHOP**

### **JOB -1**

**AIM:** Prepare a job as per given shape and dimensions.

**LHS:** Draw the Front View, Side View and Top View of the final job in first angle projection.

#### **Tools and Equipment Used:**

**LHS:** *Draw neat & labeled sketches of the following tools:*

Engineer's Scale, Scriber, Try Square, Bench Vice, Hand Hacksaw, Files: Flat file, Triangular file, Round file, Half-Round file

**RHS:** Description and uses of the tools sketched on the LHS respectively.

**Material required:** *(Mention the names of the raw materials with their size & quantity)*

**List of operations:** *(Write names only):*

**Procedure:** *(Write in third person passive voice in your practical file)*

1. File given blank to the size 65x48 mm assuring perpendicularity and flatness of the adjacent edges using bench vice, flat file and a try square.
2. Mark the job as per given dimensions.
3. Put the dot marks on the required lines with help of dot punch and hammer.
4. Place the blade in the hacksaw assuring teeth of the blade pointing in the forward direction and tighten the blade.
5. Hold the job in vice firmly and make parallel saw cuts as per marking done.
6. Cut the maximum material of job with hacksaw & file it with V section.
7. Hold the job in vice of drill machine and make a hole with a 5.15mm diameter drill bit.

#### **Precautions:**

1. Hold the job at proper height i.e. 8-10 mm above bench vice.
2. The blade should be tight enough in hacksaw to avoid the accident.
3. Tools should be kept above the edges & corners of work table.
4. The filing should be done by standing at an angle of the bench vice.
5. The hack saw should be kept straight while performing cutting operation to avoid sticking and breaking of the blade.

#### **Viva-Voce Questions**

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

**Q.1** What do you understand by fitting?

Q.2 Name various types of vice?

Q.3 Name the various parts of bench vice along with their materials.

Q.4 What is a 'Tap' and what for it is used? Name the different types of taps.

Q.5 What is the use of V-block and Center Punch?

## WELDING SHOP

### JOB 2

**AIM:** To demonstrate and study the arc welding equipment and to prepare a Lap Joint & a Butt Joint using electric arc welding process

**Material required:** *(Mention the names of the materials with their size and quantity)*

**List of operations required** *(Names Only)*

**Tools and Equipment Used:**

**LHS:** 1. Draw a labeled diagram of Electric Arc Welding setup.

2. Draw the Front, side and top views of the Lap & Butt joint in first angle projection.

**RHS:** Explain the principle and types of electric arc welding.

Explain different types of polarities.

Give the details *(with sketches on LHS page)* of following tools and equipment viz:

Electrode holder, Electrode, Chipping Hammer, Flat tongs, Wire brush, Hand shield

Hand Gloves, Apron, Welding machine, Wire cables, Cable connectors, Cable Lugs, Earthing clamps

**Procedure:** *(Write in third person passive voice in your practical file)*

1. Clean the given work pieces, using the wire brush to remove the rust, scale and other impurities.
2. Use clamps to hold your metal pieces together, if needed.
3. Switch on the welding machine power supply.
4. Place the two pieces side by side and lengthwise for making Butt Joint
5. Select the correct electrode amperage for the given work material.
6. Hold the electrode in your dominant hand by the insulated handle/holder and connect to the workpiece to the other terminal.
7. Strike/rub the tip of the electrode against the plates to be welded to initiate the spark.
8. Create the arc by adopting “make and break the circuit” technique
9. Maintain the necessary gap (approximately equal to the diameter of the electrode) between electrode and the job to keep the established arc stay as long as welding is required.
10. Use chipping hammer and remove slag formed after the welding.
11. Clean the joint with the help of wire brush.
12. Take the third piece and place it on the above welded pieces in Lap position.

13. Complete the Lap weld by following steps from 7 to 11.

**Precautions:-**

1. Use hand shield/ goggles, hand gloves, etc while welding.
2. Avoid inhaling fumes produced from the welding process.
3. Before starting the welding process inspect cables and connections to decrease the possibility of accidental electrical shock.
4. Arc welding machines utilize a high-amperage electric current which is extremely dangerous, so handle the cables and electrode with care.
5. Never weld in wet conditions or on wet material without proper training.
6. The bright light from an electric arc can cause burns similar to a sun burn, so wear long sleeved shirts and long pants to reduce exposure to welding sparks.

**Viva-Voce Questions**

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

- Q 1. Define welding and give its classification.
- Q 2. Explain with sketch leftward welding and rightward welding.
- Q 3. Briefly explain different types of polarity in arc welding?
- Q 4. Name the device used to protect your body from welding sparks.
- Q 5. Name any five welding defects.



## SHEET METAL SHOP

### JOB -3

**Aim:** To make a rectangular tray of 60x40x30 mm size from 28 Gauge G.I. Sheet.

**LHS:** 1. Paste the paper layout of the rectangular box,

2. Draw the dimensioned Front, Side and Top views of the final job in first angle projection

**Material used:** (*Mention the names of the materials with their size and quantity*)

**Tools and Equipment used** (*Describe the following tools drawing their figures respectively on the LHS*): Mallet, Thickness gauge, Snips: Straight snips, Bent snips

Stakes: Bick iron stake, Funnel stake, Horse stake, Pipe stake, Half-moon stake

**List of Operation:** (*Write names only*):

**Procedure:** (*Write in third person passive voice in your practical file*)

1. Prepare the development (layout) of the box to be made and calculate the size of the rectangular GI sheet.
2. Cut a GI sheet piece as per dimensions calculated in step 1 and do proper marking using a scribe and engineer scale (refer figure).
3. Cut the portions marked A, B and C respectively from all the four corners.
4. Turn the portions 1, 5, 8 and 12 outwards about the corresponding marked line.
5. Completely press the portions 5 and 8.
6. Bend the portions 2(a), 9 and 3(a) inwards around by 90° corresponding to the marked lines.
7. Bend the portions 2(b), 11 and 3(b) inwards around by 90° corresponding to the marked lines.
8. Completely press portions 1 and 12 outwards. Interlock 2(a) & 9 with 5, 2(b) & 9 with 5, 3(a) & 11 with 8, 3(b) & 11 with 8 and completely press it.

### **Precautions:**

1. Flatten the sheet before marking.
2. Mark the sheet carefully as per layout.
3. Cut the sheet along the lines as per marking.
4. Bend the sheet along the marked lines.
5. Ensure proper locking of the joints.
6. Do not move your finger or hand on freshly cut edges of the sheet.

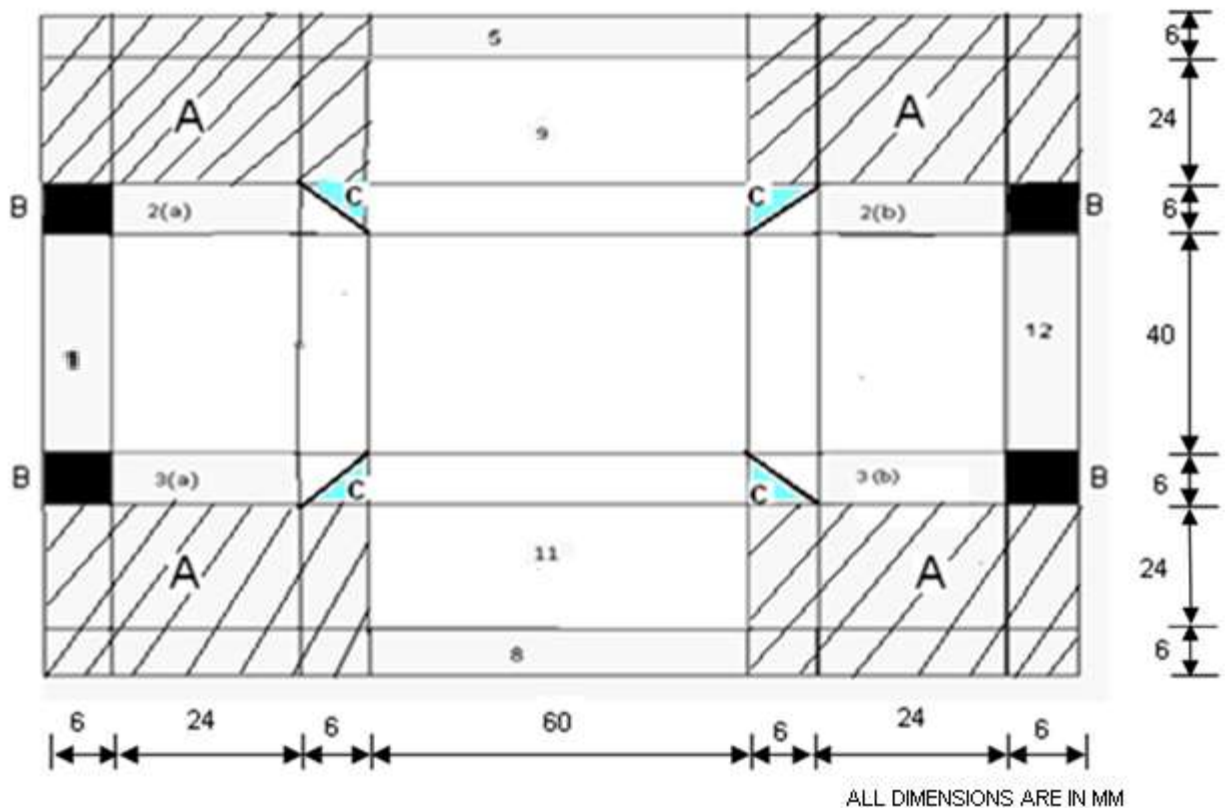


Figure showing construction lines for laying out the rectangular tray development

### Viva-Voce Questions

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

Q 1: What is G.I. sheet? How it is specified? What is the thickness of 28 gauge sheet in mm?

Q 2: What is development / layout? What is the need of development in sheet metal work?

Q 3: Name different measuring tools, marking tools and cutting tools in sheet metal shop.

Q 4: Why we use mallet in sheet metal work instead of hammer?

Q 5: Name different types of stakes used in sheet metal shop.

## FOUNDRY SHOP

### JOB -4

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

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

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

**Tools used:** Give the details (*with sketches on LHS page*) of following tools:

Moulding Boxes, Trovel, Rammer, Strike off bar, Sprue pin, Riser pin, Lifter,

**List of Operations:** (*Clearly mention the names of the operations for mould making.*)

**Procedure:** (*Write in third person passive voice in your practical file*)

- 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:

1. While making sand mould, see that the sand is of proper quality.
2. Care must be taken while making the gate and runner.
3. Ramming of the sand should be uniformly done.
4. Always wear proper shoes and clothing while working in foundry shop.
5. For safety reasons student must thoroughly understand the functionality of each equipment and tool before preparing the mould.

### Viva Voce questions:

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

Q 1: Define Pattern and Mould?

Q 2: What are the Percentages of Ingredients of Moulding sand?

Q 3: Give the list of different pattern materials.

Q 4: What is the difference between a mould and a casting?

Q5: What are cope box and a drag box? How do you identify them?

## **FITTING SHOP**

### **JOB -5**

**AIM:** To prepare a V-slot as per given drawing and dimensions.

**LHS:** Draw the Front View, Side View and Top View of the final job in first angle projection.

**Tools and Equipment Used:**

**LHS:** *Draw neat & labeled sketches of the following tools:*

Hammers: Ball peen hammer, Straight peen hammer, Cross peen hammer,  
Surface Plate, Marking Block, Twist Drill, Drilling Machine

**RHS:** Description and uses of the tools sketched on the LHS respectively.

**Material required:** *(Mention the names of the raw materials with their size & quantity)*

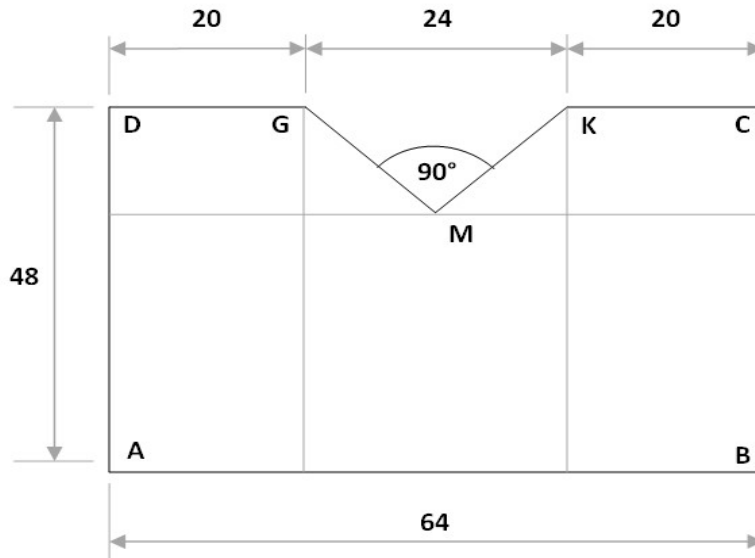
**List of operations:** *(Write names only):*

**Procedure:** *(Write in third person passive voice in your workshop file)*

**Marking Procedure:**

1. Take a Mild Steel Job-Blank having approximate dimensions 66x50x6mm
2. File-flat any two edges at right angles to get the job-blank ABCD
3. Draw line EF parallel to DC at a distance of 12mm
4. Draw line GH parallel to DA at a distance of 20mm
5. Draw line KL parallel to DA at a distance of 44mm
6. Draw line IJ parallel to DA at a distance of 32mm to cut the line EF at the point M
7. Join G&M and I&M to mark triangle MIG
8. Draw dotted lines G'M' parallel GM and K'M' parallel to KM at a distance of 1mm approximately.

9. Put dot marks on the required lines using a dot punch and a hammer.



### Cutting Procedure:

1. Cut along the diagonal G'M' and K'M' with the help of hacksaw and remove triangle M'I'G'
2. File flat and finish the edges GM and MK
3. Check with try square the angle GMK is a right angle.
4. File flat & finish the other two sides AB and BC to make ABCD a finished job with required V-Slot MGI

**Result:** The required T-slot of the given dimensions is now ready for inspection & evaluation.

### **Precautions:**

1. Hold the job at proper height (i.e. 5-6 mm) above bench vice.
2. Tighten the blade in the hacksaw properly to avoid any accident.
3. Tools should be kept on work table away from its edges & corners.
4. Filing should be done by standing in proper posture.
5. The hacksaw should be kept straight while performing cutting operation to avoid sticking and/or breaking of blade.

### **Viva-Voce Questions**

*(Write brief and to the point answers supported by sketches, wherever necessary)*

Q 1: What is vice and name various types of vice?

Q 2: Write the material of different parts of a bench vice.

Q 3: What is a Tap' and its use in fitting shop. Name different types of taps.

Q 4: What is the use of V-block?

Q 5: Differentiate between center punch, dot punch and prick punch.

## WELDING SHOP

### JOB -6

**Aim:** To demonstrate and study the gas welding equipment and to prepare a T- Joint using electric arc welding process.

**Material required:** *(Mention the names of the materials with their size and quantity)*

**List of Operation:** *(Write names only)*

#### **Tools and Equipment Used:**

**RHS:** 1. Write the principle of gas welding process.

2. Mention various types of flames *(opposite to their sketches on LHS page)*.

3. Give the details of the following elements of the gas welding equipment/tools:

- a) Gas cylinders giving colors, contents and pressures.
- b) Pressure regulators of gas cylinders.
- c) Hose and hose fitting (mention color of the pipe and the gases carried by each)
- d) Welding torch (Types, Names and labeled figures of various torches).
- e) Gas/Spark Lighter f). Filler Rod g). Wire Brush h). Flat Tongs i). Safety Goggles

**LHS:** 1. Draw a labeled diagram of Gas welding setup

2. Draw the sketches of the gas welding equipment/tools

3. Draw the Front, Side and Top views of the T- joint in first angle projection..

**Procedure:** *(Write in third person passive voice in your practical file)*

1. Clean the given work pieces, using the wire brush to remove the rust, scale and other impurities.
2. Use clamps to hold your metal pieces together, if needed.
3. Switch on the welding machine power supply.
4. Place the two pieces lengthwise centrally at right angles to each other to form a T (inverted) for making T-Joint.
5. Select the correct electrode amperage for the given work material.
6. Hold the electrode in your dominant hand by the insulated handle/holder and connect to the workpiece to the other terminal.
7. Strike/rub the tip of the electrode against the plates to be welded to initiate the spark.
8. Create the arc by adopting “make and break the circuit” technique

9. Maintain the necessary gap (approximately equal to the diameter of the electrode) between electrode and the job to keep the established arc stay as long as welding is required.
10. Use chipping hammer to remove the slag formed on the weld bead after welding.
11. Clean the joint with the help of wire brush.

**Precautions:-**

1. Use hand shield/ goggles, hand gloves, etc while welding.
2. Avoid inhaling fumes produced from the welding process.
3. Before starting the welding process inspect cables and connections to decrease the possibility of accidental electrical shock.
4. Arc welding machines utilize a high-amperage electric current which is extremely dangerous, so handle the cables and electrode with care.
5. Never weld in wet conditions or on wet material without proper training.
6. The bright light from an electric arc can cause burns similar to a sun burn, so wear long sleeved shirts and long pants to reduce exposure to welding sparks.

**Viva-Voce Questions**

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

Q 1: Name the various types of gas and arc welding process.

Q2: Why neutral flame is generally used in oxy acetylene gas welding?

Q 3: List the various fuel gases that are used for the oxy-fuel gas welding processes.

Q 4: Mention different materials used for filler rods.

Q 5: Mention the color of oxygen and acetylene gas cylinders.



## SHEET METAL SHOP

### JOB -7

**Aim:** To make a funnel of given shape and dimensions.

**LHS:** 1. Draw and paste the development of the main body and spout of the funnel separately. 2.

Draw the front view, top view and side view of final job in the first angle projection.

**Material used:** (Write material and dimensions of sheet blanks)

**Tools used:** (Mention names of the tools used)

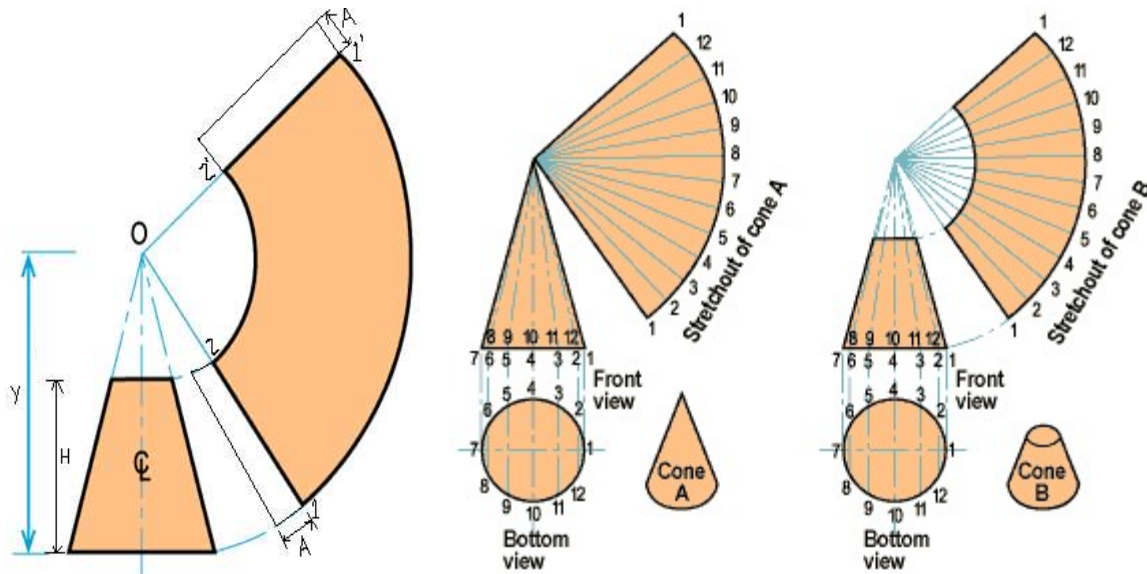
**List of Operation:** (Write names only)

**Procedure:** (Write in third person passive voice in your practical file)

1. Prepare the development (layout) of the funnel to be made.
2. Use the radial line method of pattern development to develop patterns for objects that have a tapering form with lines converging to a common point, called the apex point. The radial line method uses a series of radial generator lines drawn from a common apex point to develop a specified pattern or shape.
3. Calculate Y, the height of the apex point (of the full cone), using parameters given in the table below:-

PARTICULARS	FOR THE MAIN BODY (TOP PART)		FOR THE SPOUT (BOTTOM PART)	
	Parameter	Calculated Value (in mm)	Parameter	Calculated Value (in mm)
Height	H		H	
Bigger Diameter	D		$d_1$	
Smaller Diameter	$d_1$		$d_2$	
Bigger Circumference	$\pi D$		$\pi d_1$	
Smaller Circumference	$\pi d_1$		$\pi d_2$	
Height of full cone	$Y = HD / (D - d_1)$		$y = hd_1 / (d_1 - d_2)$	
Angle of the cone	$2\alpha = (D - d_1) / H$		$2\beta = (d_1 - d_2) / h$	

4. Cut the sheets as per development made in step 3.
5. Make a marking of 'A' margin on one side of each piece considering allowances for overlapping and bending. Marking is done with the help of steel rule and scribe.



6. Bend the sheets on these markings using a rail stake and a mallet, first in a V bend and then in a U bend.
7. Interlock the two bends and press them using a mallet assuring straightness of the lock to get a locked seam joint.
8. Fold the sheet to make spout. Giving an overlap of 'A' mm and solder the lap joint so made.
9. Insert the spout in the main body, pull it down so that the spout properly fits into the main body.
10. Solder it as lap joint on the bottom of the main body to complete the funnel.

#### Precautions:

1. Flatten the sheet before marking.
2. Marking should be done carefully.
3. Cut the sheet along the lines as per marking.
4. Bend the sheet along the marked lines.
5. Ensure proper locking of the joints.
6. Do not move your finger or hand on freshly cut edges of the sheet.

#### Viva Voice questions

*(Write brief and to the point answers supported by sketches)*

Q 1: Name the different methods of making development of sheet metal job?

Q 2: What is the difference between hem and seam joints?

Q 3: What are different types of snips? Explain their uses.

Q 4: What is soldering? Give the composition of solder used in sheet metal work.

Q 5: What is the difference soldering and brazing?

## FOUNDRY SHOP

### JOB -8

**AIM:** To make a green sand mould using a two piece pattern (screw jack body)

**LHS:** 1. Figure of front, top and side view of the pattern in first angle projection.

2. Figure showing the cut-section of the assembled mould with proper foundry terminologies.

**Tools used:** Give the details (*with sketches on LHS page*) of following tools:

Vent wire, Smoother, Swab, Draw Spike, Gate Cutter, Shovel and Bellows.

**List of Operations:** (*Clearly mention the names of the operations for mould making*).

**Procedure:** (*Write in third person passive voice in your practical file*).

- 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:**

1. While making sand mould, see that the sand is of proper quality.
2. Care must be taken while making the gate and runner.
3. Ramming of the sand should be uniformly done.
4. Always wear proper shoes and clothing while working in foundry shop.
5. For safety reasons student must thoroughly understand the functionality of each equipment and tool before preparing the mould.

**Viva Voce questions:**

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

- Q1. Name and sketch the various types of Patterns?
- Q2. What are the functions of a riser?
- Q3 Why the spure is tapered?
- Q4. What is the use of parting sand in mould?
- Q5. Explain five important properties of moulding sand.

## FITTING SHOP

### JOB -9

**AIM:** To prepare a V-Fitting as per given drawing and dimensions.

**LHS:** Draw front view, top view and side view of the final job in first angle projection.

**Material required:** *(Mention the names of the materials with their size and quantity)*

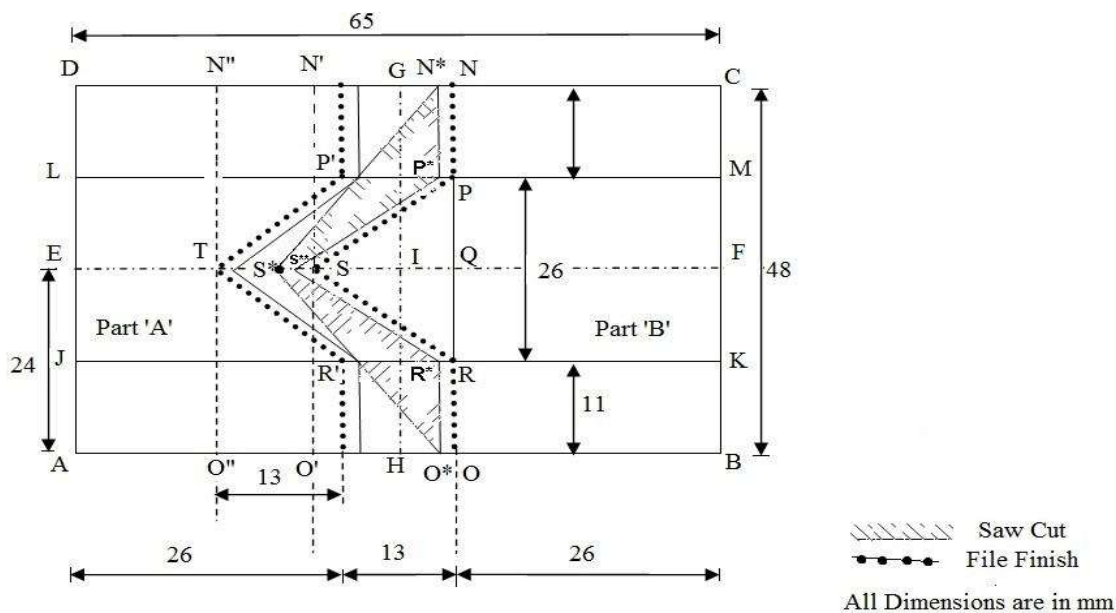
**Tools and Equipment Used:** *(Write names only)*

**List of operations:** *(Write names only)*


**Procedure:** *(Write in third person passive voice in your practical file)*

#### Marking Procedure:

1. Take a Mild Steel Blank having approximate dimensions as 66x49x6mm.
2. File-flat all the four edges at right angles and finish the blank ABCD to the dimensions 65x48x5mm.
3. Mark the centre-lines EF and GH parallel to AB and CD respectively, cutting each other at I.
4. Draw lines JK and LM at respective distances 11mm and 37 mm and parallel to AB.
5. Draw lines NO parallel to CB at a distance of 26mm from CB so as to cut LM, EF and JK at P, Q and R respectively.
6. Draw line N'O' parallel to CB at a distance 39mm from CB so as to cut LM, EF and GH at P' Q' and R' respectively
7. Draw line N''O'' parallel to CB to cut EF at Q''.
8. Mark point S along line QE such at QS = 13mm
9. Mark point T along line IE such that IT=13mm.
10. Join PS & RS and P'T & R'T.
11. Mark points N\*, S\* and O\* such at NN\*=OO\*=2mm and SS\* =4mm.
12. Join N\*S\* and O\*S\*



### Cutting Procedure.

1. Hacksaw cut along N\*S\* and O\*S\* to obtain two separate parts A & B.
2. Mark the quadrilaterals (N\*S\*S\*\*P\*) and (O\*S\*S\*\*R\*) (shown shaded and cut along the lines marked ).
3. File-flat & finish the saw cut surfaces of Part A and Part B to the required dimensions.
4. Check and show the parts A & B in the fitted position.

### Viva-Voce Questions

*(Write brief and to the point answers supported by sketches)*

- Q.1 Discuss the role of scriber in fitting shop?
- Q.2 What are different methods of filing?
- Q.3 What are tapping and dieing operations in fitting?
- Q.4 Define Counter Boring and Counter Sinking operations.
- Q.5.What are flutes in a drill? Why they are provided?

## WELDING SHOP

### JOB -10

**Aim:** To demonstrate and study the MIG welding equipment and to prepare a Lap Joint using the spot welding process.

**LHS:** Draw three views (Front, side and top view) of the welded lap joint in first angle projection.

**Material required:** *(Mention the names of the materials with their size and quantity)*

**Tools and Equipment Used:**

**List of operations required:-.**

**LHS:** Labeled diagram of MIG welding setup and spot welding setup.

**RHS:** Write the principle of MIG welding and Resistance welding processes

**Procedure:** *(Write in third person passive voice in your practical file)*

1. Cut two pieces of GI sheet of required size using snips.
2. Clean the sheets using wire brush and sand paper.
3. Select/calculate the welding parameters according to the thickness of the sheet.
4. Overlap the two sheets up to the desired length and place the overlap portion between the electrodes.
5. Press the electrodes with the help of foot paddle to get the circuit completed & hence a nugget is formed due to heat caused by the resistance between the sheets.

**Precautions:**

1. Welding parameters play an important role in deciding the quality of weld; so it must be calculated and selected properly.
2. The paddle must be kept pressed while whole of the nugget formation takes place.
3. The parallel faces of the sheet must be properly cleaned with the help of a sand paper to remove the oxide layer.

**Viva Voce questions**

*(Write brief and to the point answers supported by sketches)*

Q 1: What is resistance welding?

Q 2: Differentiate between seam and spot welding with the help of diagrams.

Q 3: What are the criteria for the selection of the values of parameters for the thickness of given workpiece?

Q4: What is meant by TIG and MIG welding?

Q 5: What do you understand by soldering and brazing?

## SHEET METAL SHOP

### JOB -11

**Aim:** To make a square mug of 50 mm side and 90 mm height using a hem joint, a locked seam joint and a double locked seam joint.

#### **LHS:**

1. Dimensioned figures of GI sheet pieces/blanks for the main body and bottom of the mug showing various margins.
2. Dimensioned figures of the front, top and side views of the completed mug in first angle projection.

**Material used:** *(Specify gauge thickness and material of the sheet used)*

**Tools used:** *(Clearly mention the names of all the tools used for making the job)*

**Procedure:** *(Write in third person passive voice in your practical file)*

1. Prepare the development (layout) of the mug to be made and calculate the size of the rectangular GI sheet required.
2. Cut three GI sheet pieces as per the calculated dimensions from development (218x100 mm and 74x74 mm)

#### Preparation of Main Body of mug

3. Take a 218x100 mm size GI sheet piece and mark median line parallel to the shorter side.
4. Now mark lines parallel to and on both sides of the median at distances 25mm, 75mm, 100 mm and 103 mm.
5. Cut 6x9 mm on all the four corners and make 6mm deep cuts along the lines 59, 109, 159 lines on the bottom sides.
6. Mark a margin of 4 mm on one of the longer side (for top) and 6 mm on the other longer side (for the bottom) and 6 mm for each on the shorter sides.
7. Bend the sheet on the top margin using a rail stake and a mallet, first in a V-bend and then in a hem joint.
8. Bend the sheet on the margin along shorter sides in U-shape in the opposite direction.
9. Fold the sheet inside at distances mentioned at distances marked at 59, 109 and 159mm in the direction opposite to the hem.



10. Interlock the two bends and press them using a mallet assuring straightness of the lock to get a locked seam joint.
11. Bend the sheets on the bottom side at  $90^{\circ}$  outwards on the marked margin.
12. The main body is ready.

Preparation of the bottom part of mug

13. Take the 74x74 mm size GI sheet piece.
14. Mark a 12 mm margin along all the four sides.
15. Cut off 12x12 mm corners of this piece
16. Bend the sides of the square blank at  $90^{\circ}$  and then on  $60^{\circ}$  using rail stake and a mallet.
17. Insert the main body in the bottom part and make double groove locked joint using a relevant stake and a mallet.

**Precautions:**

1. Flatten the sheet before marking
2. Marking should be done carefully.
3. Cut the sheet along the lines as per marking.
4. Bend the sheet along the marked lines.
5. Ensure proper locking of the joints.
6. Do not move your finger or hand on freshly cut edges of the sheet.

**Viva Voce questions**

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

Q 1: Name the sheet metal operations used for making the square mug job.

Q 2: What is difference between steel square and try square?

Q 3: What is the difference between a seam joint and locked seam joint?

Q 4: What are different sheet materials used in sheet metal shop?

Q 5: What is the difference between blanking and punching?

## FOUNDRY SHOP

### JOB -12

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

**LHS:** Figure of front, top and side view of the pattern in first angle projection.

Figure showing the cut-section of the assembled mould with proper foundry terminologies.

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

**List of Operations:** *(Clearly mention the names of the operations for mould making.)*

**Procedure:** *(Write in third person passive voice in your practical file)*

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

**Precautions:**

1. While making sand mould see that the moulding sand being used is of required specification and has all the necessary qualities of preparing a sound mould.
2. Care must be taken while making the runner and gate.
3. Ramming of the sand should be done uniformly.
4. Always wear proper shoes and clothing while working in foundry shop.
5. For safety reasons student must thoroughly understand the function of each tool and equipment before preparing the mould.

### **Viva-Voce Questions**

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

Q 1: What are cores and core prints? Why and where these are provided?

Q 2: What is meant by Master pattern?

Q 3: Explain major five casting defect.

Q 4: What is the difference between Green Sand Mould and Dry Sand Mould?

Q 5: Name the various pattern allowances and explain two important allowances.