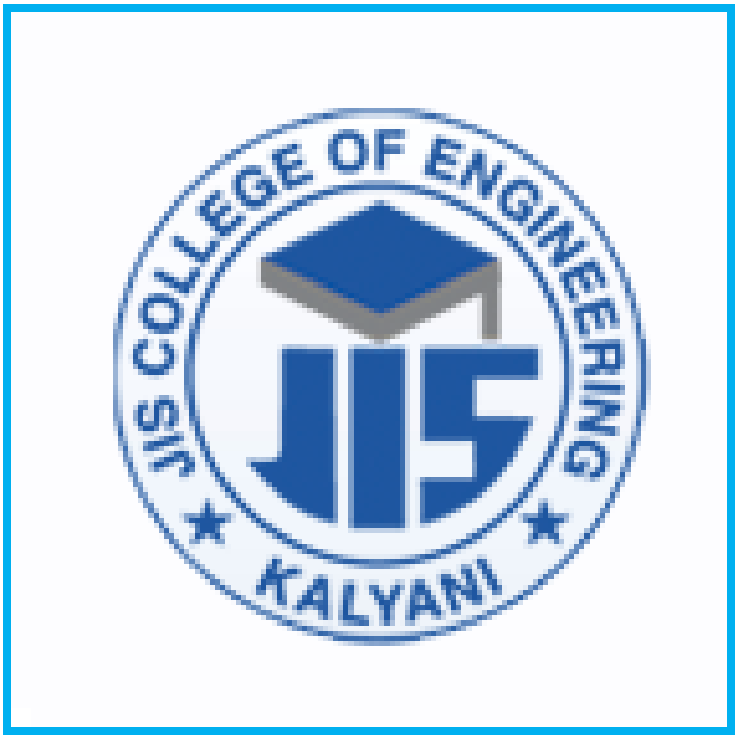
WORKSHOP PRACTICE
(ME 192/292)

(Common to all Engineering branches)



JIS COLLEGE OF ENGINEERING, KALYANI, NADIA
Mechanical Engineering Department

Details of Laboratory:

Lab in-charge: Mr. Bikash C Bhunia

The objective of this lab is to get a hands on knowledge of several Workshop Practices like carpentry, fitting, welding, machining etc and learn safety regulations to be maintained in a shop floor. This laboratory is scheduled for 1st and 2nd semester for all engineering students. Apart from curriculum, some additional experimental setups are there which helps the students to enhance their knowledge. Students also get opportunity to implement their ideas through various application oriented micro projects.

SAFETY RULES & UNSAFE PRACTICES

Remember that "accidents do not occur, they are caused". With this in mind, strictly follow the general safety rules given below and safe practices indicated in brief under each section.

1. Safety first, work next.

2. Know your job and follow instructions.

3. Avoid wearing clothing that might catch, moving or rotating parts. Long sleeves of shirts, long hair, neck tie and jewellery are definite hazards in the shop.

4. Wear safety shoes. Do not wear canvas shoes; they give no resistance to hard objects dropped on the feet.

5. Keep the area around machine or work clean.

6. Keep away from revolving work.

7. Be sure that all guards are in place.

8. One person only should operate the machine controls.

9. Use tools correctly and do not use them if they are not in proper working condition.

10. Wear safety goggles when working in areas, where sparks or chips of metal are flying.

11. Get to know who in-charge of first aid is and where boxes are placed and where the first aid can be found in case of emergency.

Course Objective:

To get a hands on knowledge of several Workshop Practices like carpentry, fitting, welding, machining etc and learn safety regulations to be maintained in a shop floor.

Course Outcome:

Upon completion of this laboratory course, students will be able to

ME 292.1. Fabricate components with their own hands.

ME 292.2. Get practical knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes.

ME 292.3. Produce small devices of their interest for project or research purpose.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	1	1	-	-	-	2	1	-	2
CO2	3	3	2	2	1	-	-	-	2	1	-	2
CO3	3	2	2	2	1	1	-	1	2	2	3	2

C O N TE N T S

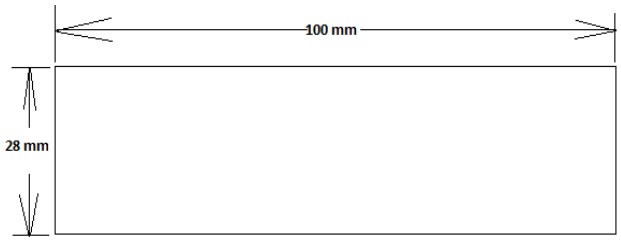
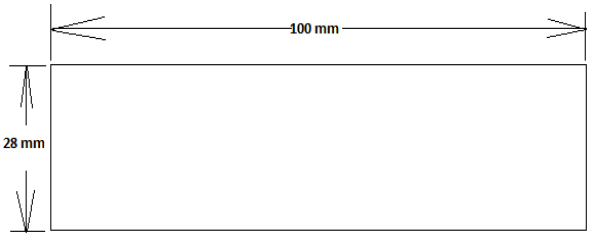
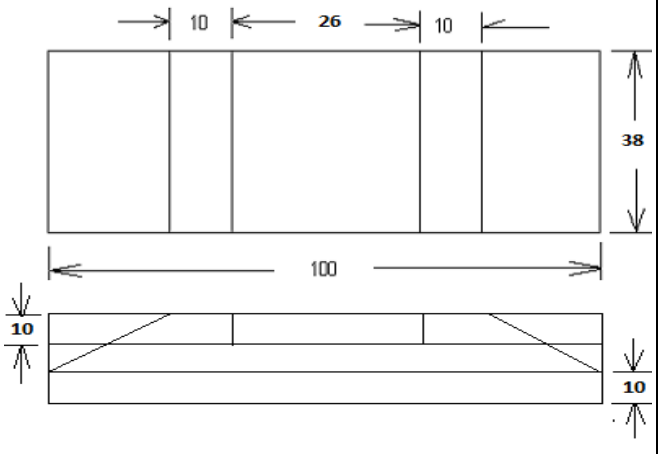
PATTERN SHOP

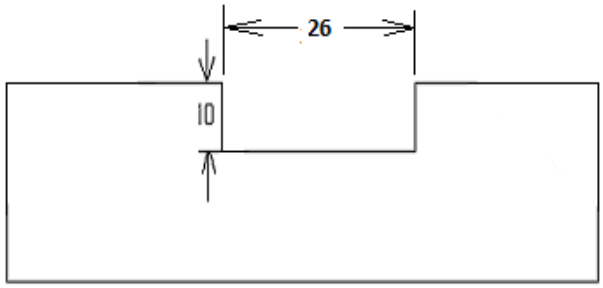
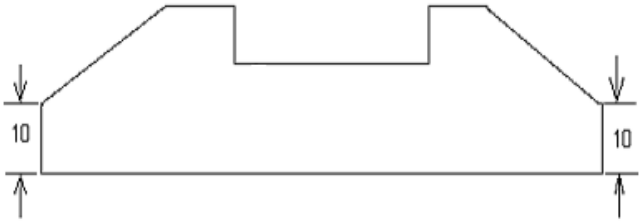
Introduction

A pattern is a model or the replica of the object (to be casted). It is embedded in molding sand and suitable ramming of molding sand around the pattern is made. The pattern is then withdrawn for generating cavity (known as mold) in molding sand.

JOB NAME:- MAKING A PATTERN

Working Procedure:

Sl. No.	Procedure	Instrument Name	Fig.
1	Cutting as per Length from the long Wood piece.	Hand Saw, Try Square, Steel Rule & Bench Vice.	
2	Surface Plane Of Top, Bottom, Front & Back Side of the Wood piece.	Jack Plan & Bench Vice	
3	Marking as per Drawing	Pencile & Try Square	

4	Groove Cutting	Flat Chisel & Ball Peen Hammer	
5	Inclined Surface Cutting	Flat Chisel & Ball Peen Hammer	

LABORATORY EXERCISE:

1. What are the basic safety required in Pattern Shop.
2. What is pattern? State the function of pattern.
3. What are the common materials used for pattern making. Discuss their merits and demerits.
4. What is the difference between pattern and casting?
5. Define he core prints and core boxes with sketch
6. Explain the various types of patterns used in foundry shop with sketch.
7. How many type of pattern allowances?

Mapping with CO and Bloom's Taxonomy level:

Question No.	CO	Bloom's Taxonomy level
1	1	1
2	2	1
3	2	1
4	2	1
5	2	1
6	2	1
7	2	1

FITTING SHOP

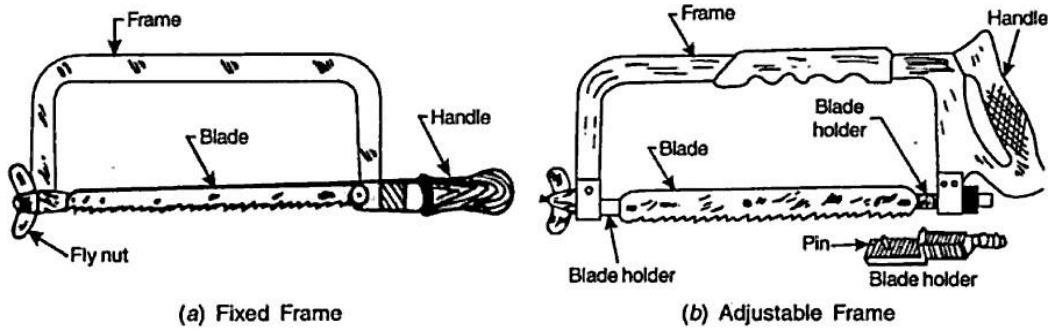
Introduction:

The bench work and fitting plays an important role in engineering. Although in today's industries most of the work is done by automatic machines which produces the jobs with good accuracy but still it (job) requires some hand operations called fitting operations. The person working in the fitting shop is called fitter.

Fitting Tools:

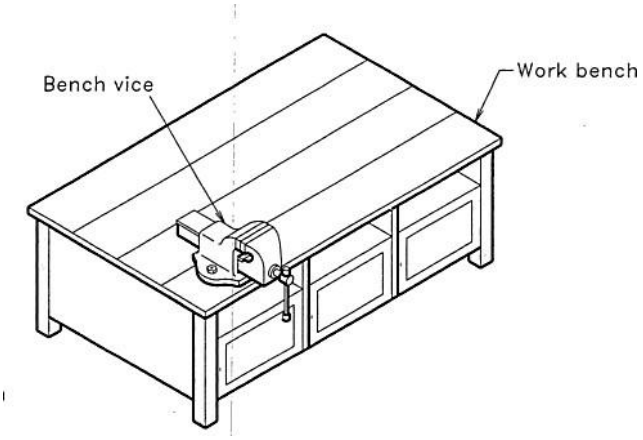
Fitting shop tools are classified as below:

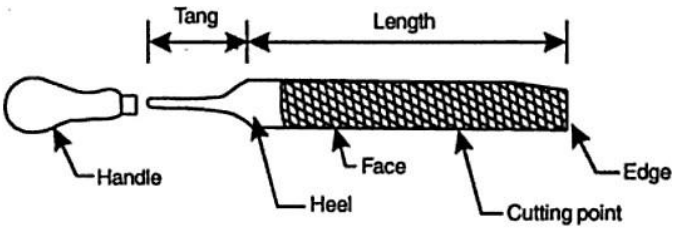
TOOLS REQUIRED WITH SPECIFICATION		
Sl. No.	**Tools Used**	**Specification**
1	**MARKING TOOLS**	
	Steel Rule	12” in length
	Try Square	8” in length
	Scriber	10” in length
	Centre punch	4” in length
2	**CUTTING TOOLS**	
	Hack Saw	300 X 12.5 X 0.67
	Cold Chisel	12” in length
	Flat file	12” in length
	Square File	8” in length
3	**STRIKINGTOOLS**	
	Ball Peen hammer	0.5 Kg.
4	**HOLDING DEVICE**	
	Fitter’s Vice	6” or 8” jaw length



(a) Fixed Frame (b) Adjustable Frame

Fig Hack Saw

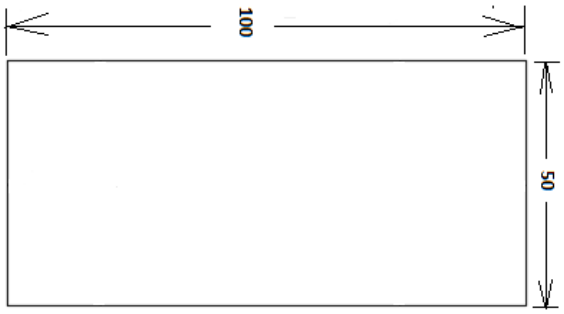
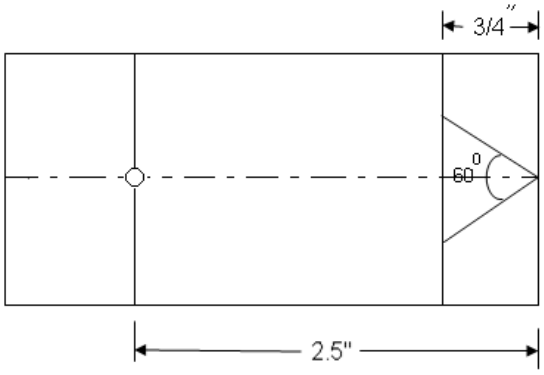


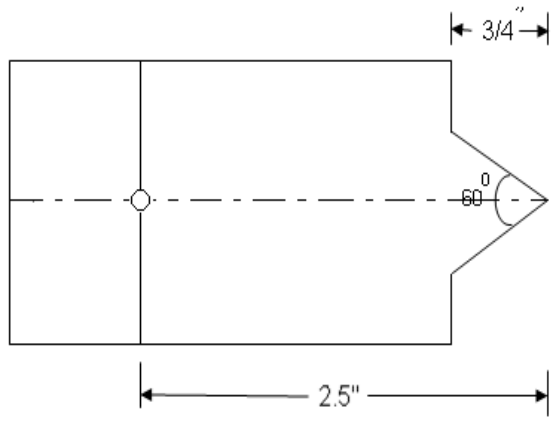
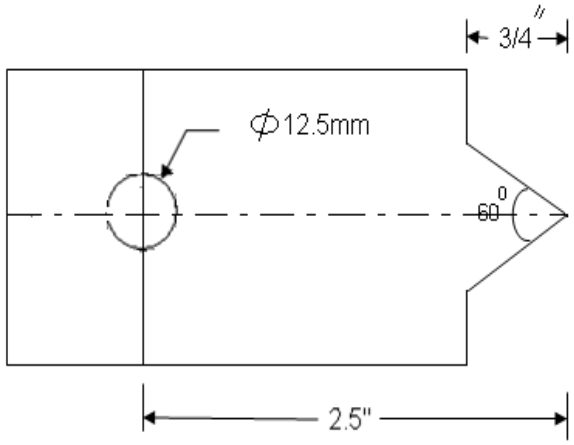
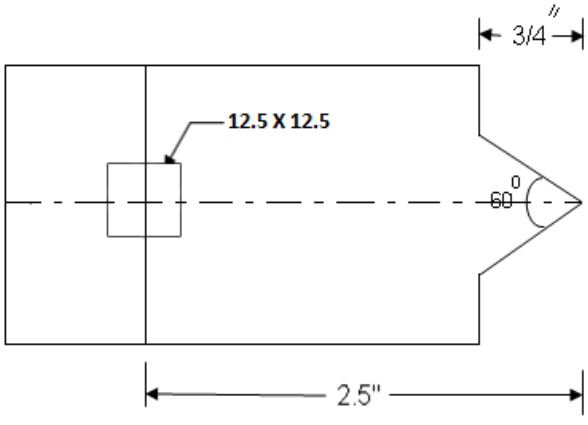


Nomenclature of a File

JOB NAME:- MAKING A GAUGE IN MS PLATE

WORKING PROCEDURE:

Sl. No.	Procedure	Instrument Name	Fig.
1	Make the Perpendicular Four corner Side with Respect a Particular Base.	Flat file and Try Square.	
2	Marking as Per Drawing.	Scriber, Try Square, Center Punch and Hammer	

3	Cutting as per Marking.	Hacksaw & vice	
4	Make a Through Hole.	Drill Machine.	
5	Make a Square from The above Hole.	Square File & vice.	

LABORATORY EXERCISE:

1. What are the basic safety required in Fitting Shop.
2. State the functions of different shop in mechanical workshop.
3. What are the different types of tools used in fitting shop? State their purpose of uses. Draw some instruments figure.
4. What are the uses of various types of files? Describe with sketch.
5. What are the differences between the hammer used in carpentry shop, fitting shop and smithy shop with sketch.

Mapping with CO and Bloom's Taxonomy level:

Question No.	CO	Bloom's Taxonomy level
1	1	1
2	1	1
3	3	1
4	3	1
5	4	1

MACHINE SHOP

Machine workshop Introduction:

Machine shop is a place in which metal parts are cut to the required size and put together to form mechanical units or machines. The machines so made are to be used directly or indirectly in the production of necessities and luxuries of civilization. Machine shop is the base of all mechanical production.

PRECAUTIONS:

The following precautions should be taken during the experiment:

a) Do not remove metal or wood chips from the table or stock by hand. Use a brush or other tool to properly remove chips or shavings from the table or stock.

b) Never leave the key in the chuck. Do not let go of the key until it is free of the chuck and secured in its proper holding place.

c) Never attempt to run the chuck on or off the spindle head by engaging the power.

d) Do not stop the rotation of the chuck by reversing the power to the lathe unless tapping holes.

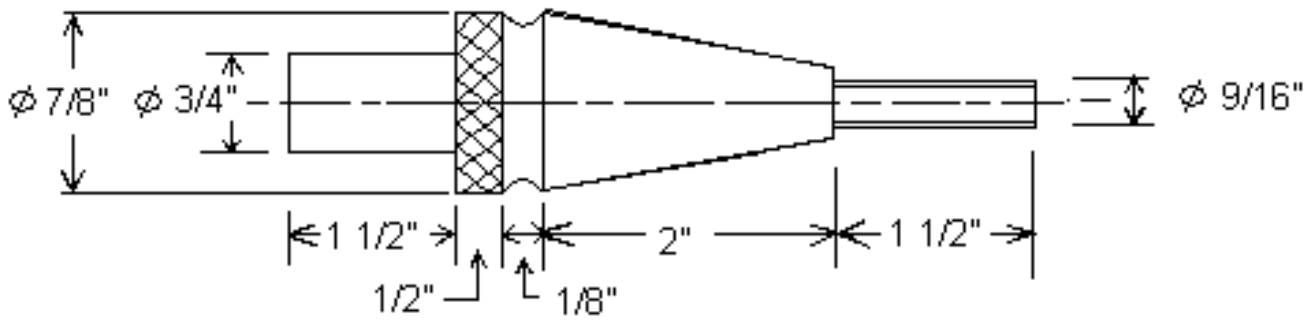
e) Do not leave tools, bits or excess pieces of stock on the lathe bed. All belts and pulleys must be guarded.

f) Stop the machine immediately if odd noise or excessive vibration occurs.

JOB NAME:- MAKING A PIN FROM MS ROUND BAR

JOB FIGURE:-

OPERATING INSRTUCTIONS IN LATHE:



1. Ensure the serviceability of the apparatus & instruments.

2. Ensure General cleanliness of the experimental setup.

3. Check the calibration date of the instruments used (if any).

4. The operating instructions are as follows:

a) At first hold the work piece/job in chuck / face plate

b) After holding the job, centering must be properly done for secured machining process.

c) Turn the chuck or faceplate by hand to ensure there is no binding or danger of the work striking any part of the lathe.

d) Check to ensure the cutting tool will not run into the chuck. If possible, feed away from the chuck.

e) Before starting the lathe, ensure the spindle work has the cup center imbedded; tail stock and tool rests are securely clamped; and there is proper clearance for the rotating stock.

f) Prior to starting the lathe, ensure that small diameter stock does not project too far from the chuck without support from the tail stock center.

g) The operator must always be aware of the direction and speed of the carriage or cross feed prior to engaging the automatic feed.

h) Select turning speed carefully. Large diameter stock must be turned at a very low speed. Always use the lowest speed to rough out the stock prior to final machining.

i) The correct speed and feed for the specific material and cutting tool must be used. Stop the machine before making adjustments or measurements.

j) After finished the work on the lathe, the power must be shut off and the machine must come to a complete stop.

LABORATORY EXERCISE:

1. What are the basic safety required in Machine Shop.
2. What is a machine tool?
3. How a lathe is specified?
4. Define cutting speed, feed and depth of cut in lathe.
5. What materials are commonly used as cutting material?
6. Write functions of lead screw and feed rod of a lathe machine.
7. Name and explain five operations that can be performed on a lathe machine.
8. What are the purpose of the cutting fluid? What are the types?
9. What do you mean by nomenclature of cutting tool? Explain it with fig.

Mapping with CO and Bloom's Taxonomy level:

Question No.	CO	Bloom's Taxonomy level
1	1	1
2	1	1
3	4	2
4	4	1
5	3	2
6	4	3
7	4	2
8	4	2
9	4	6

WELDING SHOP

INTRODUCTION TO WELDING PROCESSES

Objective:

To study and observe the welding techniques through demonstration and practice ARC

WELDING PROCESSES:

Welding is a process in which two materials, usually metals, and is permanently joined together by coalescence, resulting from temperature, pressure, and metallurgical conditions. The particular combination of temperature and pressure can range from high temperature with no pressure to high pressure with any increase in temperature. Thus, welding can be achieved under a wide variety of conditions and numerous welding processes have been developed and are routinely used in manufacturing.

To obtain coalescence between two metals following requirements need to be met: (1) perfectly smooth, flat or matching surfaces, (2) clean surfaces, free from oxides, absorbed gases, grease and other contaminants, (3e) metals with no internal impurities. These are difficult conditions to obtain. Surface roughness is overcome by pressure or by melting two surfaces so that fusion occurs. Contaminants are removed by mechanical or chemical cleaning prior to welding or by causing sufficient metal flow along the interface so that they are removed away from the weld zone friction welding is a solid state welding technique. In many processes the contaminants are removed by fluxing agents.

The production of quality welds requires (1) a satisfactory heat and/or pressure source, (2) a means of protecting or cleaning the metal, and (3) caution to avoid, or compensate for, harmful metallurgical effects.

ARC WELDING

In this process a joint is established by fusing the material near the region of joint by means of an electric arc struck between the material to be joined and an electrode. A high current low voltage

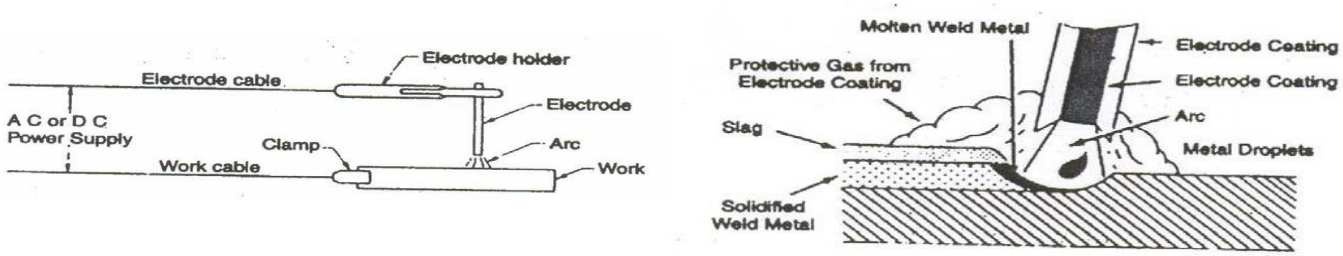


Fig 4.1: The Basic circuit for arc welding

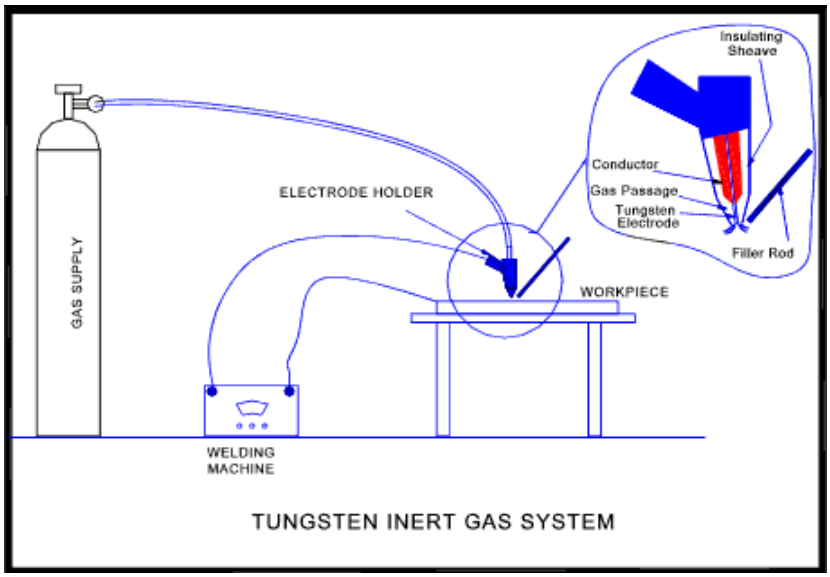


Fig 4.2: Schematic diagram of shielded metal arc welding (SMAW)

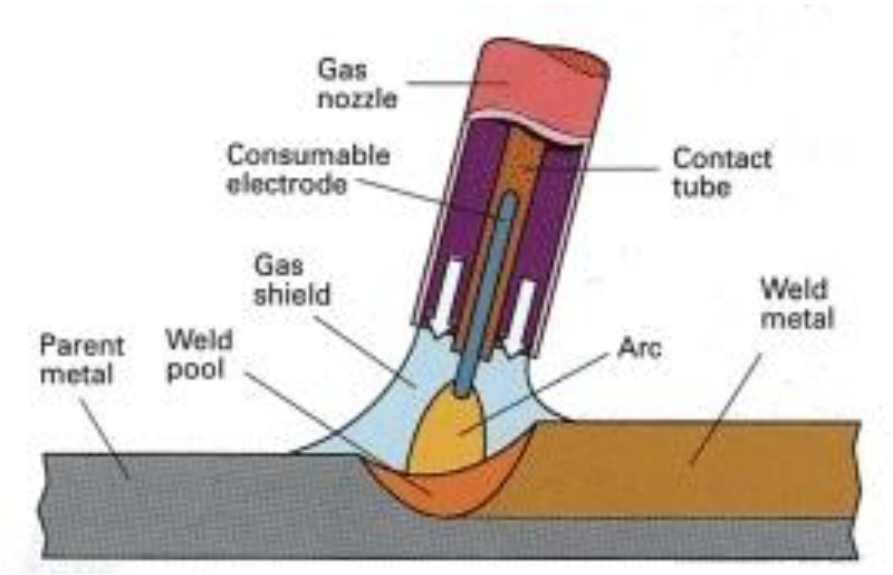


Fig 4.3: Schematic diagram of gas metal arc welding (GMAW)

electric power supply generates an arc of intense heat reaching a temperature of approximately 3800OC. The electrode held externally may act as a filler rod or it is fed independently of the electrode. Due to higher levels of heat input, joints in thicker materials can be obtained by the arc welding process. It is extensively used in a variety of structural applications. 6 There are so many types of the basic arc welding process such as shielded metal arc welding (SMAW), gas metal arc welding (GMAW), gas tungsten arc welding (GTAW), submerged arc welding Fig 4.1: The Basic circuit for arc welding Fig 4.2: Schematic diagram of shielded metal arc welding (SMAW) Fig 4.3: Schematic diagram of gas metal arc welding (GMAW) 7

LABORATORY EXERCISE

ARC WELDING

Job Name: Butt Joint

Material Supplied: Mild steel plate of size 100X50X5 mm – 2 No's

Welding Electrodes: M.S electrodes 3.1 mm X350 mm

Welding Equipment: Air cooled transformer Voltage-80 to 600 V 3 phase supply, amps up to 350

Tools and Accessories required:

1. Rough and smooth files.
2. Protractor
3. Arc welding machine (transformer type)
4. Mild steel electrode and electrode holder
5. Ground clamp
6. Tongs
7. Face shield
8. Apron
9. Chipping hammer.

Sequence of operations:

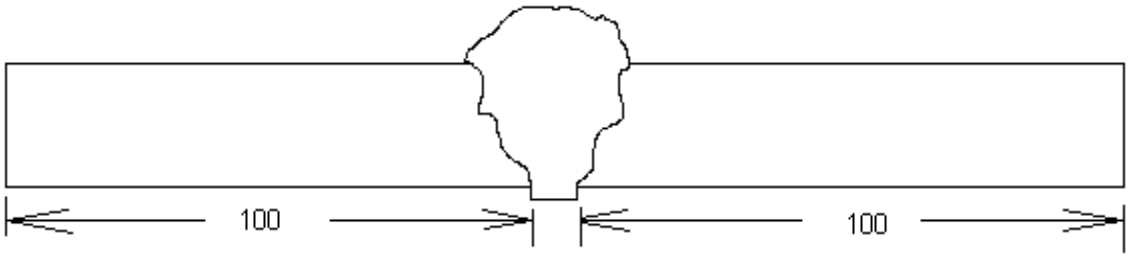
1. Marking
2. Cutting
3. Edge preparation (Removal of rust, scale etc.) by filling
4. Try square leveling
5. Tacking
6. Welding
7. Cooling
8. Chipping
9. Cleaning

Procedure:

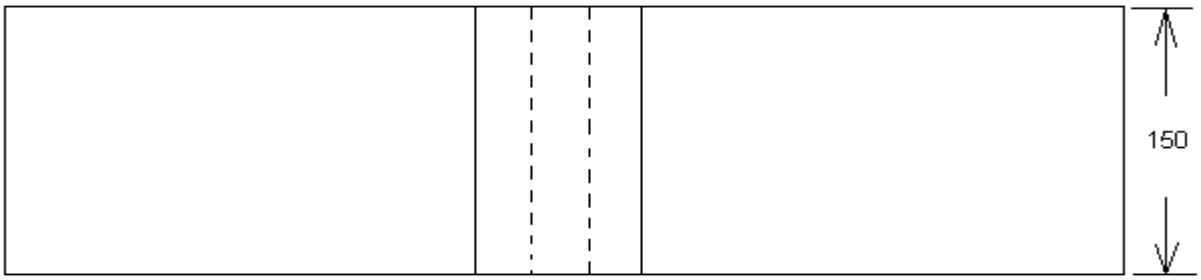
1. The given M.S pieces are thoroughly cleaned of rust and scale.
2. The two pieces are positioned on the welding table such that, the L shape is formed. The tongs are made use of for the purpose.
3. The electrode is fitted in the electrode holder and the welding current is ser to be a proper value.
4. The ground clamp is fastened to the welding table.
5. Wearing the apron and using the face shield, the arc is struck and the work pieces are tack- welded at both the ends and at the centre of the joint.
6. The alignment of the corner joint is checked and the tack-welded pieces are

required.

7. The scale formation on the welds is removed by using the chipping hammer.
8. Filling is done to remove any spanner around the weld.



FRONT VIEW



TOP VIEW

GAS WELDING

In this process, a joint is established by fusing the material near the region of joint by means of a gas flame. The common gas used is mixture of oxygen and acetylene which on burning gives a flame temperature of 3300OC. A filler rod is used to feed molten material in the gap at the joint region and establish a firm weld. The flame temperature can be controlled by changing the gas composition i.e. ratio of oxygen to acetylene. The color of flame changes from oxidizing to neutral to reducing flame.

LABORATORY EXERCISE:

1. What are the basic safety required in Welding Shop.
2. What are the different methods for metal joining?
3. Give the definition of MMA welding
4. What are the equipments used in MMA welding.
5. State the difference between AC and DC welding.
6. Why are edges prepared?
7. What is an electrode?
8. What are the common welding defects?
9. What is root line?
10. Draw a circuit diagram of MMA welding.
11. Give the definition and state the principles of Oxy-acetylene gas welding/
12. Draw the typical Gas-Welding circuit diagram.

13. Write notes on the following
    i) Carburized Flame
    ii) Neutral flame
    iii) Oxydised Flame
14. Why is the Oxygen cylinder kept lying on the floor.
15. Why is Neutral flame used for welding.
16. State the difference between soldering and brazing.

Mapping with CO and Bloom's Taxonomy level:

Question No.	CO	Bloom's Taxonomy level
1	1	1
2	1	2
3	1	1
4	4	1
5	4	4
6	4	3
7	4	1
8	4	2
9	4	1
10	4	4
11	4	1
12	4	4
13	4	2
14	4	2
15	4	2
16	4	4

SMITHY SHOP

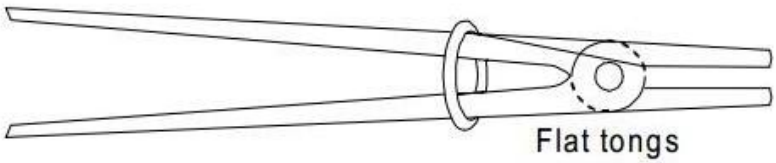
Introduction:

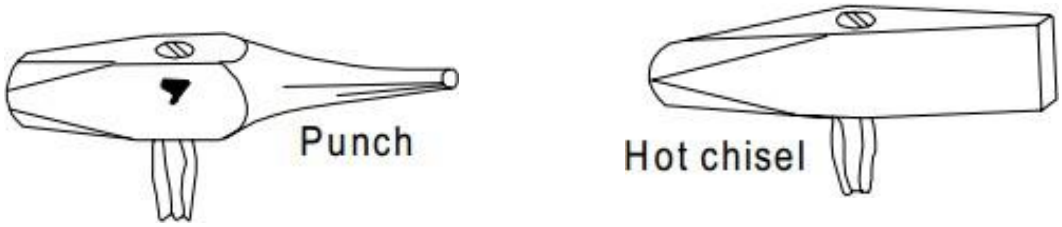
Blacksmithy or Forging is an oldest shaping process used for the producing small articles for which accuracy in size is not so important. The parts are shaped by heating them in an open fire or hearth by the blacksmith and shaping them through applying compressive forces using hammer.

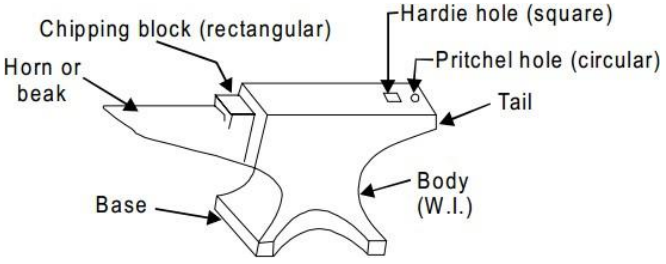
Hand forging process is also known as black-smithy work which is commonly production of small articles using hammers on heated jobs. It is a manual controlled process even though some machinery such as power hammers can also be sometimes used. Black-smithy is, therefore, a process by which metal may be heated and shaped to its requirements by the use of blacksmith tools either by hand or power hammer.

COMMON HAND FORGING TOOLS

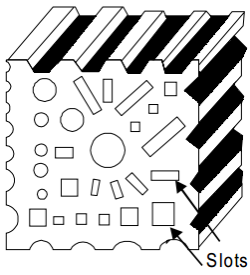
For carrying out forging operations manually, certain common hand forging tools are employed. These are also called blacksmith's tools, for a blacksmith is one who works on the forging of metals in their hot state. The main hand forging tools are as under.







Anvil



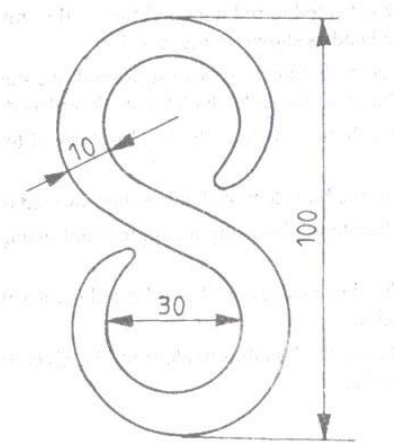
Swag

Job Name: To make a S-hook from a given round rod, by following hand forging operation.

Tools required:

Smith's forge**,** Anvil**,** 500gm and I kg ball-peen hammers, Flatters, Swage block, Half round tongs, Pick- up tongs, Cold chisel.

Sequence of operations:



S- HOOK

1. One end of the bar is heated to red hot condition in the smith's forge for the required length.
2. Using the pick-up tongs; the rod is taken from the forge, and holding it with the half round tongs, the heated end is forged into a tapered pointed end.
3. The length of the rod requires for S-hook is estimated and the excess portion is cut-off, using a cold chisel.
4. One half of the rod towards the pointed end is heated in the forge to red hot condition and then bent into circular shape as shown.
5. The other end of the rod is then heated and forged into a tapered pointed end.
6. The straight portion of the rod is finally heated and bent into circular shape as required.
7. Using the flatter, the S-hook made as above, is kept on the anvil and flattened so that, the shape of the hook is proper.

NOTE:

In-between the above stage, the bar is heated in the smith's forge, to facilitate forging operations.

Result:

The S-hook is thus made from the given round rod; by following the stages mentioned above.

Precautions:

1. Hold the job carefully while heating and hammering
2. Job must be held parallel to the face of the anvil.
3. Wear steel-toed shoes.
4. Wear face shield when hammering the hot metal
5. Use correct size and type of tongs to fit the work.

LABORATORY EXERCISE:

1. Explain in brief the various safety precautions associated with the forging shop.
2. Sketch and describe the following :
   (A) Anvil (B) Swage Block (C) Set hammers
3. Describe press forging. How does it differ from drop forging?
4. Explain in brief the defects in forging.
5. What is the difference between Smithing and Forging ?

Mapping with CO and Bloom's Taxonomy level:

Question No.	CO	Bloom's Taxonomy level
1	1	1
2	1	2
3	1	2
4	1	2
5	1	4