POORNIMA
COLLEGE OF ENGINEERING

Manufacturing Practices Workshop
Lab Manual

(Lab Code: - 1FY03-25/ 2FY03-25)
I/II Semester, First Year

Department of First Year

Session 2023-24

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RTU SYLLABUS

List of Experiments

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1. T-lap joint
2. Briddle joint

Foundry shop

3. Mould of any pattern
4. Casting of any simple pattern

Welding shop

5. Lap joint by gas welding
6. Butt joint by arc welding
7. Lap joint by arc welding
8. Demonstration of brazing, soldering & gas cutting

Machine shop

9. Job on lathe with one step turning and chamfering operations

Fitting shop

10. Finishing of two sides of a square piece by filing
11. Making mechanical joint and soldering of joint on sheet metal.
12. To cut a square notch using hacksaw and to drill a hole and tapping

LAB-RULES

DO'S FOR THE LAB	DON'TS FOR THE LAB
1. Always listen carefully to the teacher and follow instructions. **2.** Know where the emergency stop buttons are positioned in the workshop. If you see an accident at the other side of the workshop you can use the emergency stop button to turn off all electrical power to machines. **3.** Always wear an apron as it will protect your clothes and hold loose clothing such as ties in place. **4.** Wear good strong shoes, training shoes are not suitable. **5.** Keep hands away from moving/rotating machinery. **6.** Use hand tools carefully, keeping both hands behind the cutting edge. **7.** Report any damage to machines/equipment as this could cause an accident.	**1.** Do not run in the workshop, you could 'bump' into another pupil and cause an accident. **2.** Do not use a machine if you have not been shown how to operate it safely by the teacher. **3.** Do not drop the tools. **4.**Do not leave running machine unattended **5.** Do not work in a haphazard manner. **6.** Do not touch moving parts, belts or rotating tools. **7.** Do not drop the tools.

LAB PLAN

Total Number of Experiment:-

Total Number of Turns Required:-

Number of Turns Required For

Experiment Number	Turns	Scheduled Day
Experiment No.-1	1	
Experiment No.-2	2	
Experiment No.-3	3	
Experiment No.-4	4	
Experiment No.-5	5	
I Midterm exam	6	
Experiment No.-6	7	
Experiment No.-7	8	
Experiment No.-8	9	
Experiment No.-9	10	
Experiment No.-10	11	
II Midterm exam	12	
End term exam	13	

Distribution of Lab Hours: - 3 Hour/Week

Activity	Time (in minutes)
Attendance	10
Explanation of Experiment & Logic	50
Experiment Performance	50
File Checking	30
Viva/Quiz	20
Solving of Queries	20

List of Experiments (With Rotor Plan)

Rotor-1

Carpentry Shop

Experiment No.-1

Object:-To prepare a T lap joint of wooden piece as per drawing.

Experiment No.-2

Object:-To prepare a T lap Bridle joint of wooden piece as per drawing.

Welding Shop

Experiment No.-3

Object:-To perform butt joint on a given work piece as per given dimensions by using electric arc welding.

Experiment No.-4

Object:-To make a lap joint on a given work piece as per given dimensions.

Machine Shop

Experiment No.-5

Object: - To Prepare a Job on lathe with one step turning and chamfering operations.

Rotor-2

Fitting Shop

Experiment No. 6

Object: - To cut a square notch using hacksaw and finish its two side in fitting shop.

Experiment No. -7

Object: - Describe the procedure to produce a job in fitting shop and drill three holes on pcd and tapping.

Welding Shop

Experiment No. -8

Object: - To perform butt joint on a given work piece as per given dimensions by using Gas welding.

Foundry Shop

Experiment No. -9

Object: - To prepare a mould and Aluminum casting with the help of given wooden pattern.

Sheet Metal Shop

Experiment No. -10

Object:- To prepare funnel as per drawing in sheet metal shop.

Demonstration of Brazing, Soldering & Gas Cutting.

EXPERIMENT No.1

Object:-To prepare a T lap joint as per drawing.

Tools & Equipments: Try square, scale, pencil, carpentry vice, marking gauge, hammer, screwdriver, measuring tools etc.

Materials: Wooden piece (120×40×30) mm.

Theory:

The carpentry deals with the constructional work such as making roof, floors, partitions etc. of a building by means of wood with the help of carpentry tools.

TIMBER: The timber is the material used for carpentry and joinery work. It is the wood obtained from exogenous trees by cutting these trees after their full growth. The following technical terms relating to timber must be clearly understood:

1. Standing or stationary timber. It is the timber obtained from a living tree.
2. Rough timber. It is the timber obtained after felling a tree.
3. Converted timber. It is the timber, which has been sawn into various market sizes such as beams, battens, planks etc
4. Dressed timber. It is the timber, which has been sawn, placed and worked to the required condition.
5. Structural timber. It is the timber used in framing and load bearing structures.

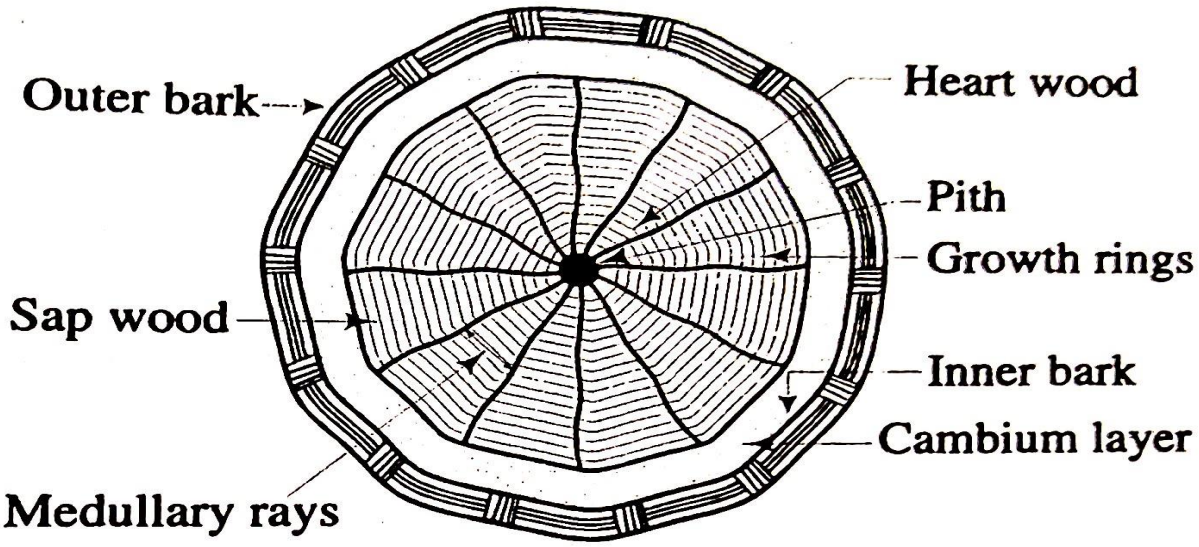


Fig. Exogenous Tree Wood

Advantages of Timber:

1. It is easily available and can be quickly transported by simple means
2. It is lighter and stronger than most of the materials used in construction work.
3. It is a non-conductor of heat and electricity.

Types of Timber:

Soft wood: It is widely used for building construction work. These are resinous light in colors and weight, easy to be worked, have good tensile resistance but week across the fibers.
Hard wood: It is widely used for doors, furniture, joinery etc. It is non-resinous, dark in colors and heavier in weight and have well tensile as well as shear resistance. So it is difficult to be worked.

Seasoning Of Timber: The seasoning of timber is the process of drying timber or removing moisture or sap, present in a freshly felled tree, under controlled conditions. The common methods are commonly used for seasoning of timber.

Natural Seasoning or Air Seasoning:

In this method of seasoning, the tree, after cutting is converted into logs, planks or battens. These are stacked in a dry place about 300 mm. above the floor level with longitudinal and cross pieces arranged one upon another.
This method of seasoning the wood is simple and cheap, but it is very slow and extends over years depending upon the type of wood and its cross section.

Artificial Seasoning Or Kiln Seasoning:

This method of seasoning is the quickest of all the commonly used wood seasoning process. This process is carried out in a chamber under controlled temp. And humidity conditions with proper air circulation and ventilation system. Usually, steam is used for this purpose.

Defects In Timber:
1. Defects developed during the growth of a tree.
2. Defects occurring during conversion, seasoning or use
3. Defects due to the action of fungi and insects

Natural Defects:
1. **Knots**: The impression left behind by the broken limbs or branches later appear as knots.
2. **Shakes**. When the tree is not cut even after attaining full maturity the cohesion between the wood grains is lost due to evaporation of jumps, moisture, resins and oils etc.
3. **Irregular grains or twisted fibers**: Such defects occur due to twisting of tree in different directions due to the blowing wind.
4. **Rind or galls burls:** These are the wounds created by the irregularly broken or cut branches at the place where they part off.

Qualities of Good Timber:
1. It should have straight fibers.
2. It should be free from knots.
3. It should not possess natural defects.
4. On sawing, it should give a sweet smell.
5. It should not carry sudden change in colors; such a change is always a sign of disease.

Preservation of Timber: In order to protect the timber from internal decay and attack of insects like white ants, some chemical preservation are used to increase the life of timber and to make the timber structures durable.

Preservatives: Tar oil, Water soluble chemical salts, Organic solvent chemicals

Method Of Application Of Preservatives:

1. Brush and spray method. 2. Dipping or soaking treatment
3. Pressure treatment

Wood Working Hand Tools:

A broad classification of these tools according to their use is as follows.

1. Marking and measuring tools.
2. Holding and supporting tools
3. Cutting tools
4. Planning tools
5. Boring tools
6. Striking tools
7. Miscellaneous tools

Marking And Measuring Tools:

Try square: It is used for measuring and setting out dimensions, testing the finish of a plane surface, and checking of right angle.

Straight edge: It is used for testing the trueness of surfaces and edges.

Bevel square: It is used for setting, duplicating, testing and comparing angles and bevels.

Scriber or Marking knife: It is mainly used for locating and marking points and scribing lines on wood surface.

Marking gauge: It is made of wood and is a very prominent tool for marking. Scribing (along the line of desired distance) is made possible with the help of thumbscrew.

Holding and Supporting Tools:

Carpentry Vice: It is a heavy table of rigid construction on which two or four vices are fitted on opposite sides to hold the jobs during the operation.

Clumps and screws: Various types of clamps and screws are used by carpenters for holding and supporting wood pieces in position for carrying out different operations. 'C' clamp, Hand screw

Cutting tools: There are three types of cutting tools used in the wood work:

Saws:-

Those, which are given a reciprocating, motion by hand and carry teeth for cutting the wood.

Chisels

Those, which are driven into the wood by the application of blows-.

Those which are given a swinging action by one hand or both hands and are struck against the wood for cutting the same.

Types of Saws:

1. Ripsaw: It cuts the wood along the grain. It is used for smaller and medium work.

2. Panel saw: It is the most commonly used handsaw. It is mainly used for cutting panels for the door shutters.

3. Compass saw: It carries a tapered blade. The blade is quite flexible and, thus it can be used easily for taking straight or curved cuts on outside or inside of the wood.

4. Keyhole saw: This saw is very useful in internal and intricate work.
5. Cross cut saw: It is primarily designed for cutting across the grains of wood but is used as a general purpose saw in woodwork.
6. Tanoan saw or back saw: It is used for finer work than the rip saw, panel saw or cross cut saw. The main use of this saw is in taking short straight cuts, such as for tenons.
7. Dovetail saw: It is also used for finer work, particularly for cutting tongues for dovetail joints.

Types of Chisels:

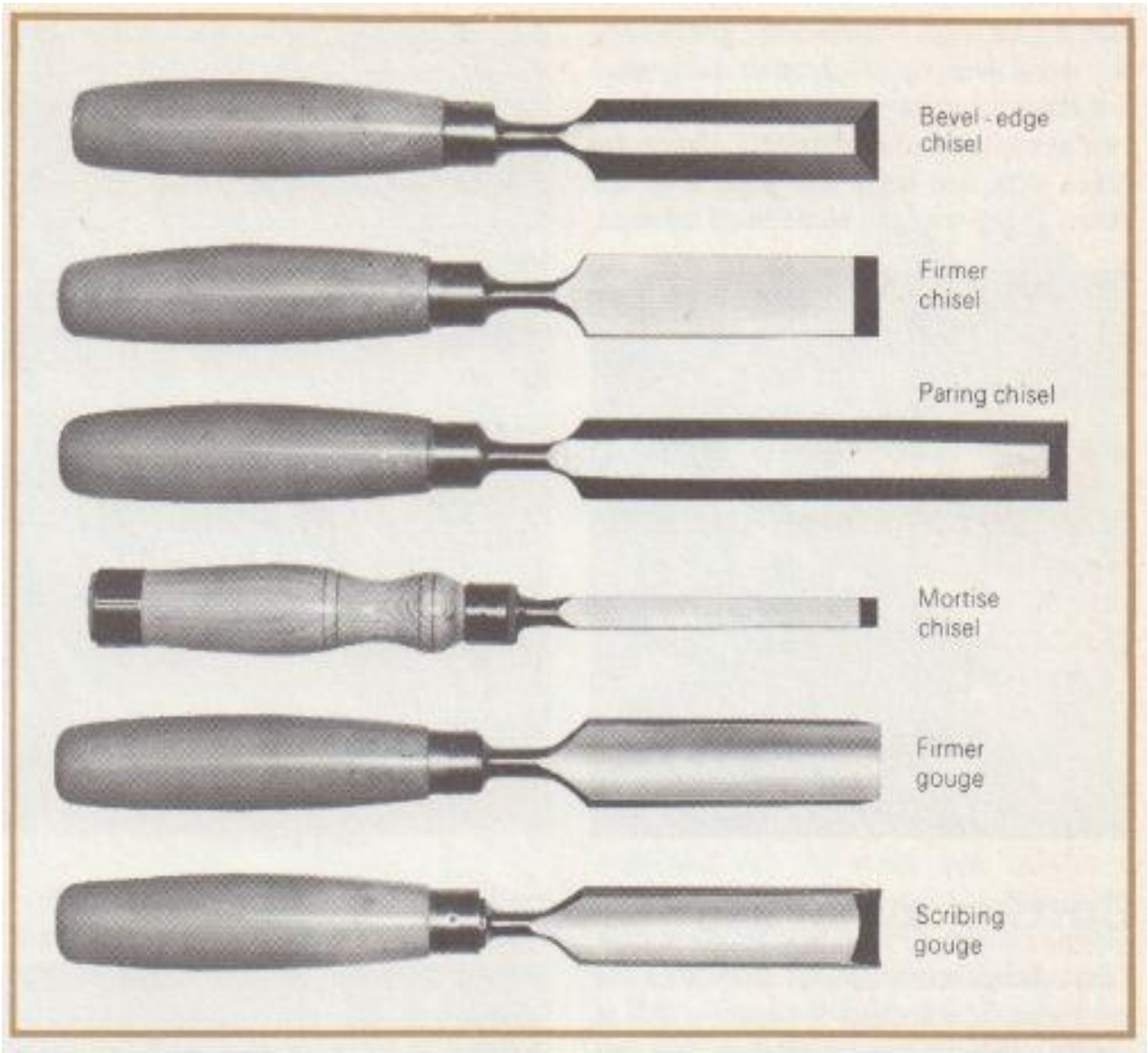
Firmer chisel: It is a general-purpose chisel and is use for taking wider cuts and finishing flat surfaces inside the grooves.

Dovetail chisel: The beveled shape enables reduction of blade thickness on the sides due to which it can enter sharp corners to finish them.

Mortise chisel: It is use or taking heavy and deep cuts resulting in more stock removal, as in case of making mortises.

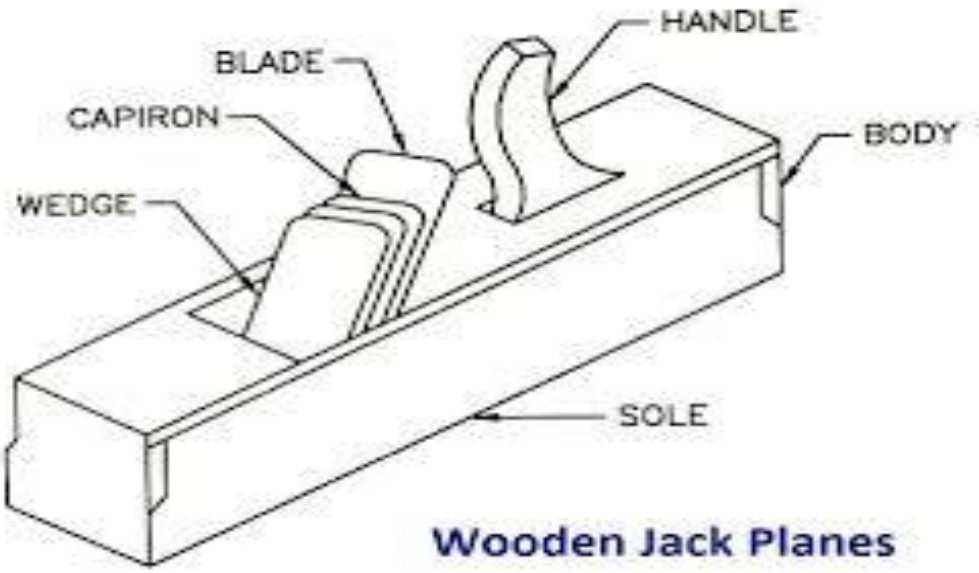
Socket chisel: When a very heavy stock removal is to be done by the chisel, it is bound to result in splitting of the wooden handle due to heavy blows on its top.

Gouge chisel: It carries a hollow curved blade for finishing curved surfaces.

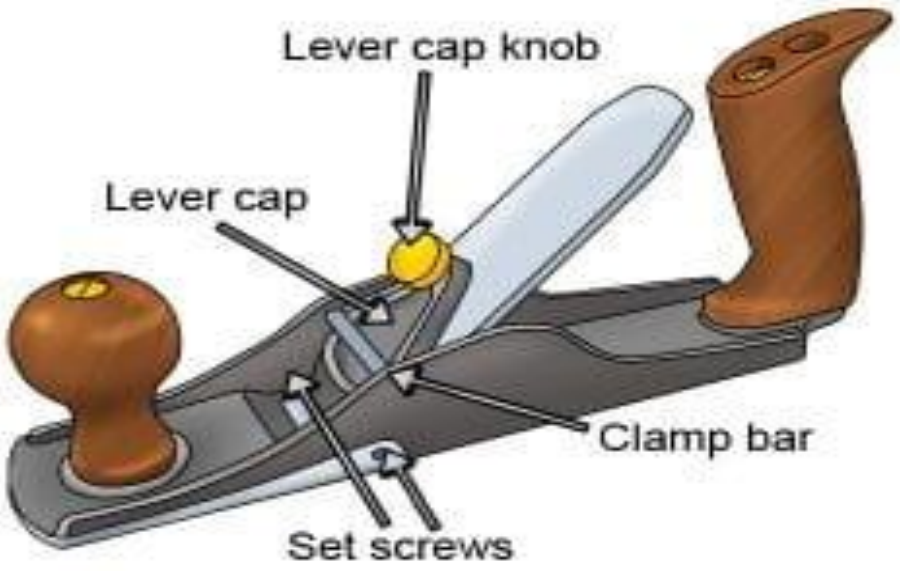


Planing Or Paring Tools:

1. **Wooden Jackplane:** It is the most commonly used plane. The main cutting part (Blade) is make by High Carbon Steel. This is cutter remain at 45 degree angle with the sole.



2. **Steel Jackplane**: It is also used for the same purpose as a wooden jackplane, but it gives a better finish than the latter. It is more rigid than others and has longer life than others, but is equally costly also.



Striking Tools:

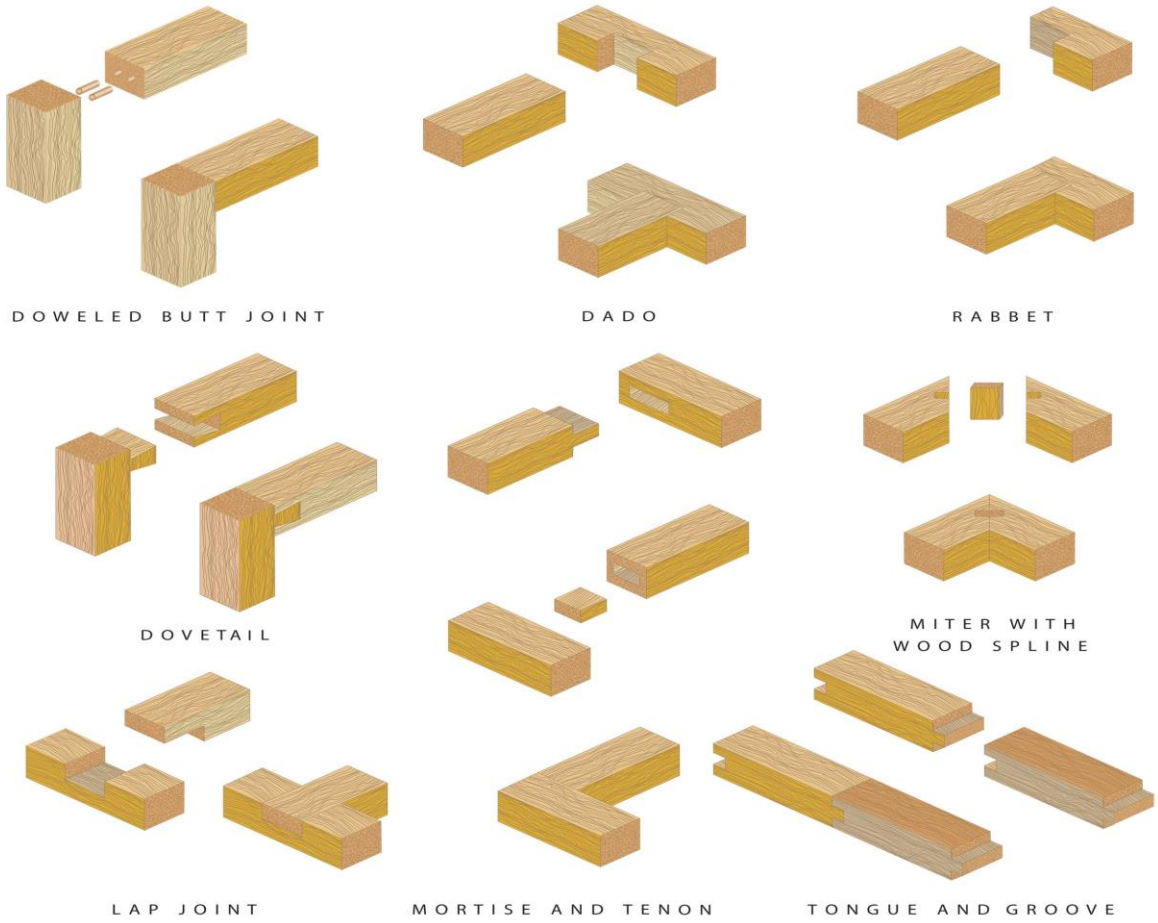
1. **Mallet:** It is used for striking the cutting tools, which have a wooden handle.

2. Claw hammer: It consists of two faces.

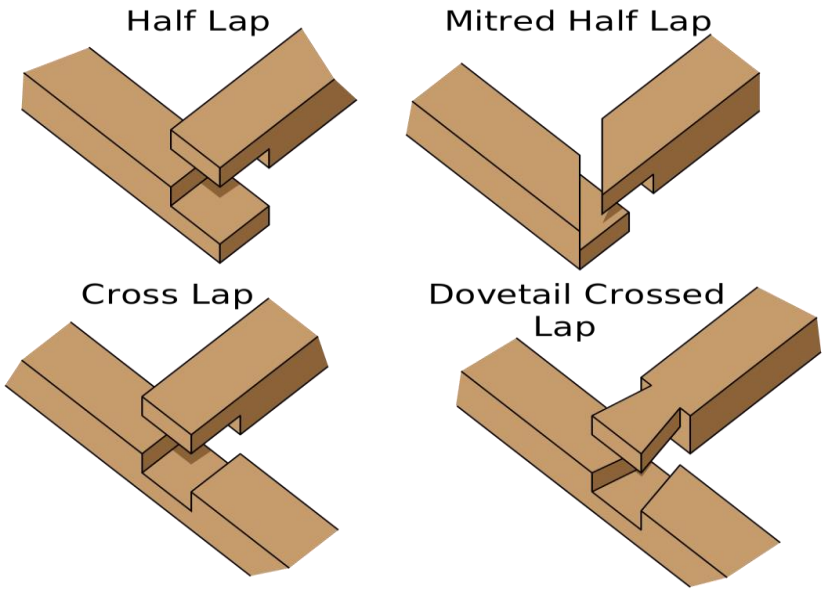
1. Striking face used for striking purposes
2. Claw used for extracting nails out of the wood.

Types of Joints:

1. Lap Joint
2. Butt Joint
3. Bridle Joint
4. Corner Joint


DOWELED BUTT JOINT
DADO
RABBET
DOVETAIL
MITER WITH WOOD SPLINE
LAP JOINT
MORTISE AND TENON
TONGUE AND GROOVE

T Joints:


Half Lap
Mitred Half Lap
Cross Lap
Dovetail Crossed Lap

Job Diagram

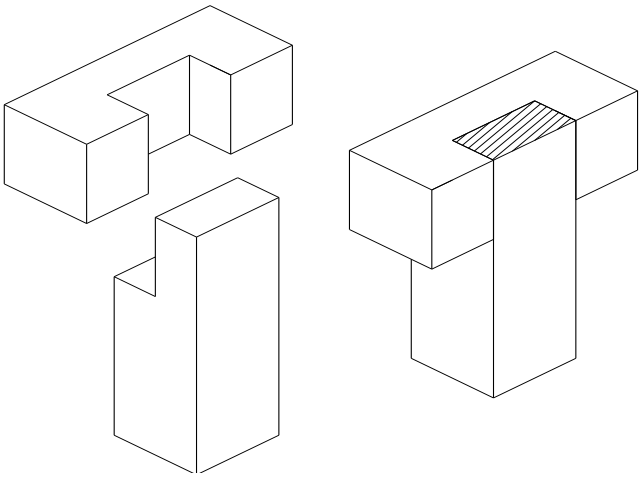


Fig.:- T-Lap Joint

Procedure:

1. Collect tools & material from workshop store.
2. Plane the piece of in rectangular shape as per dimensions.
3. Mark the exact location on the surface where the joint in to be made.
4. Hold the job on carpentry vice.
5. Make groove of required width and depth.
6. Select the type of fastener (nails, screw, wooden pin)
7. Hold piece to be joined in their respective position.
8. Check the joint.

Result: T lap joint / bridle joint as pre given dimension has been made.

Safety precautions:

1. Use properly sharpened tools.
2. Use seasoned wood.
3. Tools should be in proper conditions.
4. Don’t place the wood against the direction of grains.
5. Grip of vice should be strong while material is being worked.

EXPERIMENT No. 2

Object:-To prepare a T Bridle joint as per drawing.

Tools & equipments: Try square, scale, pencil, carpentry vice, marking gauge, hammer, screwdriver, measuring tools etc.

Materials: Wooden piece.

Procedure:

1. Collect tools & material from workshop store
2. Plane the piece of in rectangular shape as per dimensions.
3. Mark the exact location on the surface where the joint in to be made.
4. Hold the job on carpentry vice.
5. Make groove of required width and depth.
6. Select the type of fastener (nails, screw, wooden pin)
7. Hold piece to be joined in their respective position.
8. Check the joint.

Job Diagram

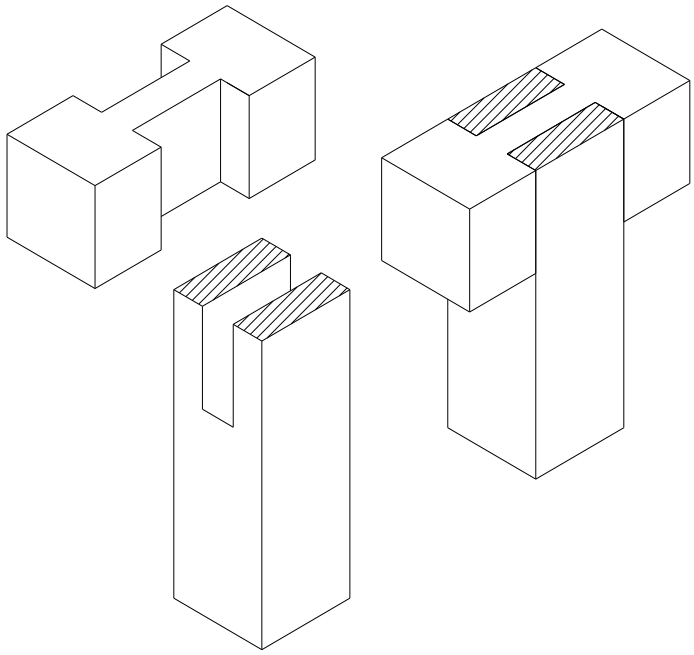


Fig.:- T- Briddle Joint

Result: T lap bridle joint as pre given dimension has been made.

Safety precautions:

1. Use properly sharpened tools.
2. Use seasoned wood.
3. Tools should be in proper conditions.
4. Don't place the wood against the direction of grains.
5. Grip of vice should be strong while material is being worked.

VIVA VOICE

Q. (1) What is carpentry?
Q. (2) What is timber and their advantage?
Q. (3) What are the main defects in timber?
Q. (4) What are the carpentry tools used in carpentry shop?
Q. (5) What are different types of joints?
Q. (6) What is seasoning and advantage of seasoning?
Q. (7) What is preservation of timber?

EXPERIMENT NO. 3

Object: -To perform step turning and chamfering operation on lathe m/c as per drawing.

Tools & Materials :- Lathe m/c single point cutting tool, steel rule, outside caliper, tool.

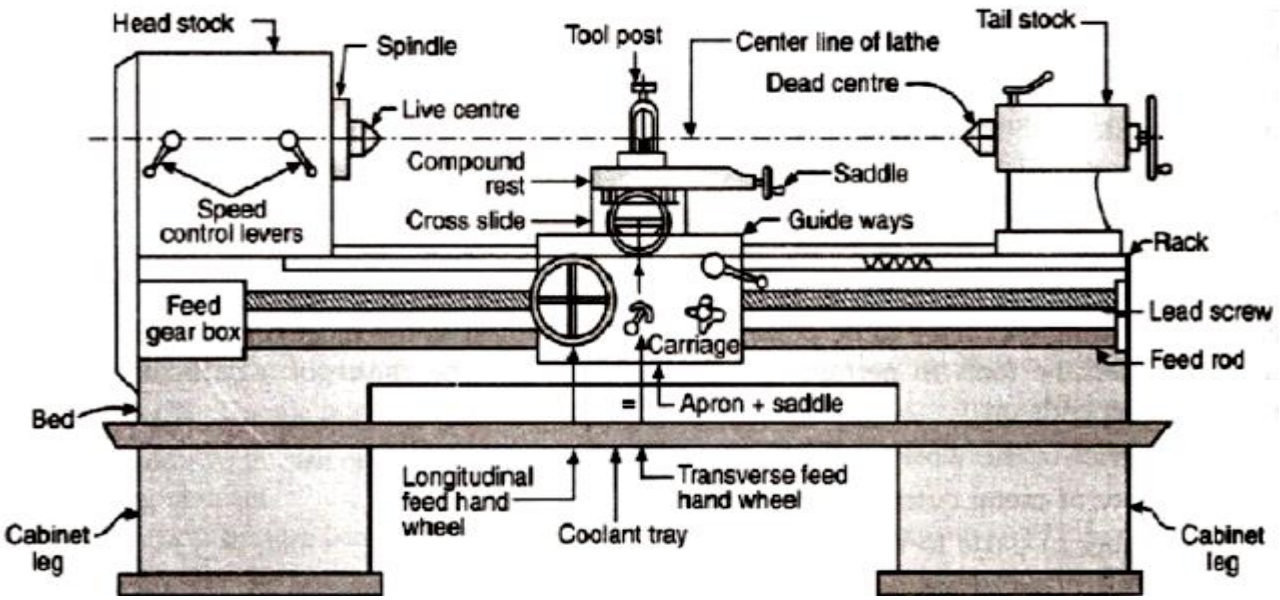
Materials: -MS Rod. (ϕ32*65 mm)

THOREY:-

LATHE MACHINE

A lathe is a machine tool that works by spinning an object around on a horizontal axis so that various tools can be applied to it. The work is done through the rotational force of the spinning object.

Working Principle: The lathe is a machine tool which holds the work piece between two rigid and strong supports called centers or in a chuck or face plate which revolves. The cutting tool is rigidly held and supported in a tool post which is fed against the revolving work. The normal cutting operations are performed with the cutting tool fed either parallel or at right angles to the axis of the work.



1. **Bed**: The bed is a heavy, rugged casting in which are mounted the working parts of the lathe. It carries the headstock and tail stock for supporting the work piece and provides a base for the movement of carriage assembly which carries the tool.
2. **Legs**: The legs carry the entire load of machine and are firmly secured to floor by foundation bolts.
3. **Headstock**: The headstock is clamped on the left hand side of the bed and it serves as housing for the driving pulleys, back gears, headstock spindle, live centre and the feed reverse gear. The headstock spindle is a hollow cylindrical shaft that provides a drive from the motor to work holding devices.
4. **Gear Box**: The quick-change gear-box is placed below the headstock and contains a number of different sized gears.

5. **Carriage**: The carriage is located between the headstock and tailstock and serves the purpose of supporting, guiding and feeding the tool against the job during operation. The main parts of carriage are:

a) S**addle** is an H-shaped casting mounted on the top of lathe ways. It provides support to cross-slide, compound rest and tool post.

b) C**ross slide** is mounted on the top of saddle, and it provides a mounted or automatic cross movement for the cutting tool.

c) C**ompound rest** is fitted on the top of cross slide and is used to support the tool post and the cutting tool.

d). **Tool post** is mounted on the compound rest, and it rigidly clamps the cutting tool or tool holder at the proper height relative to the work centre line.

e). A**pron** is fastened to the saddle and it houses the gears, clutches and levers required to move the carriage or cross slide.

6. **Tailstock**: The tailstock is a movable casting located opposite the headstock on the ways of the bed. The tailstock can slide along the bed to accommodate different lengths of work piece between the centers.

LATHE OPERATIONS

The engine lathe is an accurate and versatile machine on which many operations can be performed. These operations are:

1. Turning: - The process in which material is removed by a cutting tool from work piece.

2. Facing: - The process in which material is removed from the surface that is perpendicular to the axis of rotation.

3. Parting/ Grooving**: -** The process of making grooves and parting of parts.

4. Drilling: - To process of generate a hole.

6. Boring: - The process of enlarge the previous hole as per our requirement.

7. Knurling: - To make a rough surface for gripping purpose.

8. Threading: The process of making threads internal and external.

9. Forming / Chamfering: - The process used to cut and angle on edge of work piece.

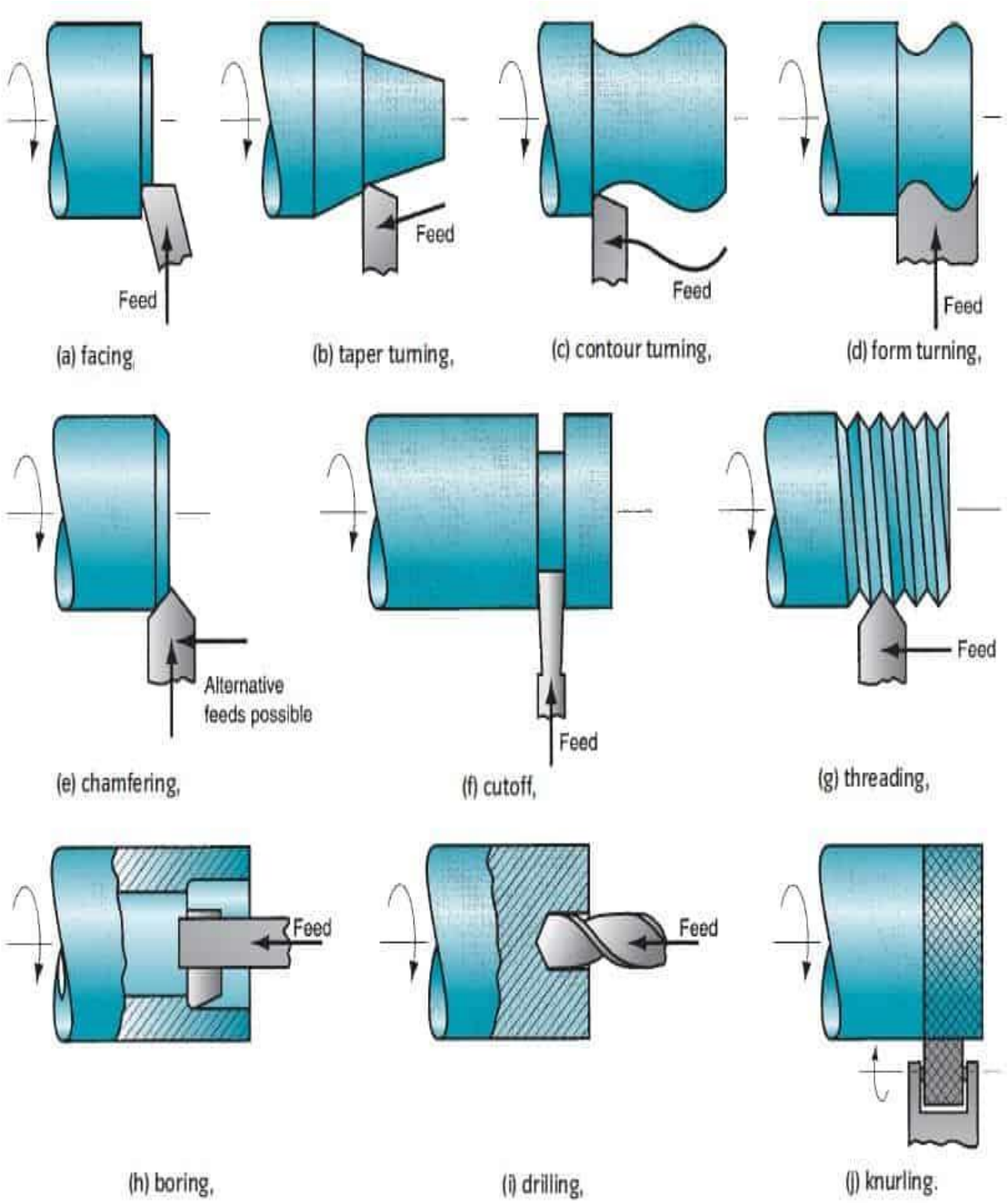
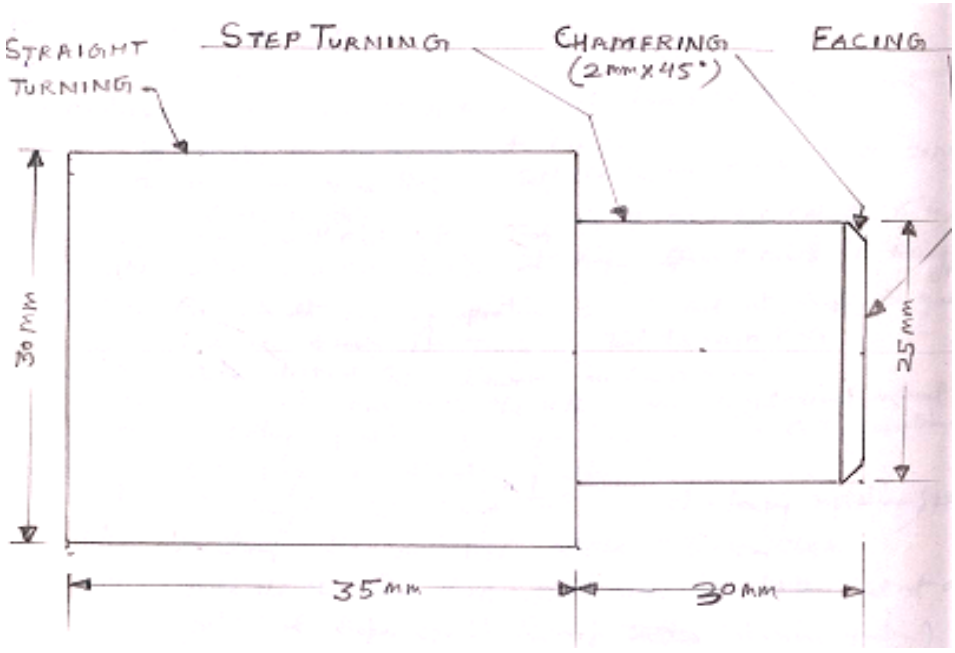


Fig.:- Lathe Operations

Procedure:-

1. Collect tools material from work shop store check for measurement
2. Hold the work piece in self centering chuck 20mm set single point cutting tool in the tool post.
3. Select and set m/c at proper speed feed, cross slide, depth of cut and longitudinal slide for facing operation.
4. For straight turning operation set tool at straight to your position lock it touch tool to work piece.
5. Give depth of cut division on cross wheel.
6. Start m/c and with help of longitude wheel feed.
7. To cutting operation again give feed and cutting operation till required diameter of job.
8. Set single point cutting tool for chamfering at 45 degree.
9. Unclamp work piece from chuck
10. Hold the work piece back side in chuck select and set tool proper operation for operation step turning,
11. Check dimension as per drawing and finish the job.

Job Diagram



Result: -Step turning &chamfering operation as per given dimension has been done

Precaution: -

1. Chuck key in not to be left in the chuck after tightening job
2. Keep yourself away from revolting parts
3. Safety general should be on
4. Do not leave m/c unattended in running condition.

EXPERIMENT NO. 4

Object:-To perform butt joint on a given work piece as per given dimensions by using electric arc welding.

Tools and Materials:-Mild steel flat, AC Transformer, cables, cable connector, Earthing Plate, electrode holder, electrode, apron , Welding goggle, leather gloves, chipping hammer, chisel, Wire brush.

Theory:-

Welding is a process in which two materials, usually metals, and is permanently joined together by coalescence, resulting from temperature, pressure, and metallurgical conditions.

TYPES OF WELDING

The welding is broadly divided into the following two groups:

1. Plastic or pressure welding. In this welding process, the surfaces which are to be welded is firstly heated up to their molten stage and then they are joined by applying pressure. In this case no filler material is used.

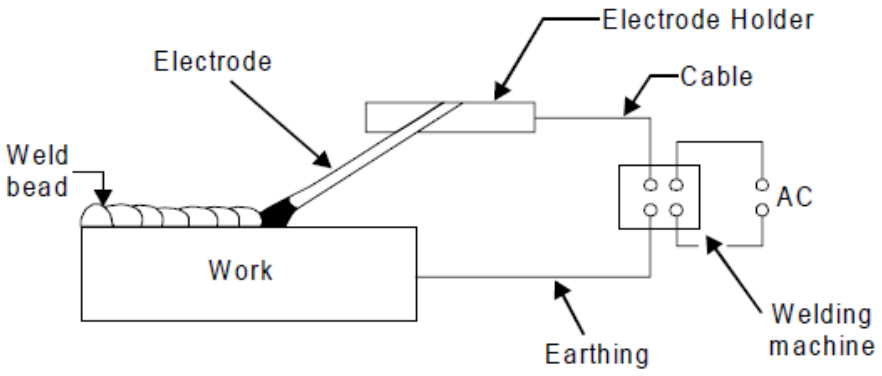
2. **Fusion or non-pressure welding** In this process, the surfaces which are to be welded are kept together and heated by a heating source (such as flame or electric arc), till they reach the molten stage. In addition to this, a filler metal is used.

Plastic or Pressure Welding

Principle

Pressure welding uses friction or explosion to heat the joining section of metal work pieces and join them under pressure. The process is also called solid-state welding. Pressure welding is a generic term for welding methods that weld work pieces by applying mechanical pressure on the joining section.

Arc Welding Equipment's:



The most commonly used equipment for arc welding consist of following.

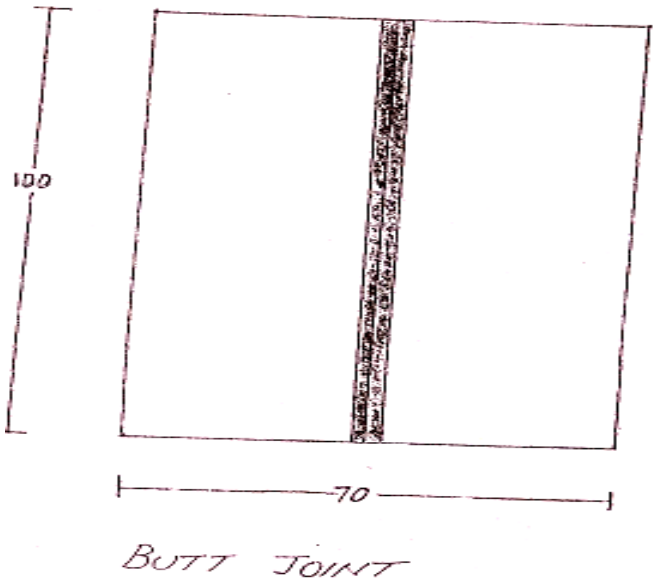
1. AC or DC machines
2. Electrodes.
3. Electrode holder
4. Cables, cable connections
5. Cable lugs

6. Chipping hammer
7. Earthing clamps
8. Wire brush
9. Helmet
10. Safety goggles
11. Hand gloves
12. Apron

Working Principle of Arc Welding

Arc welding is a welding process, in which heat is generated by an electric arc struck between an electrode and the work piece. Electric arc is luminous electrical discharge between two electrodes through ionized gas.

Job Diagram



Comparison between A.C. Arc Welding and D.C. Arc Welding

A.C. arc welding	D.C. arc welding
1 The AC welding transformer has no moving parts and is simpler. 2. The transformer costs less and its maintenance cost is low. 3. Since the distribution of heat is equal, therefore there is no need for changing the polarity. Hence only ferrous metal are usually welded by AC 4. All types of electrodes cannot be used in AC arc welding because the current constantly reverses with every cycle. Only coated electrodes can be used 5.A.C.is more dangerous	1. The D.C. welding generator has rotating parts and is more complicated. 2. The generator costs more and its maintenance cost is high 3. Heat distributions different in two poles, i.e., two-third in positive and one third in negative. By changing the polarity all types of metals can be welded by D.C. 4 All types of electrodes bare or coated can be used in D.C. arc welding because the polarity can be changed to suit the electrode. 5. D.C. is comparatively less dangerous.

Electrodes:

(a**) Consumable electrodes:** It provides the source of the filler metal in arc welding. These electrodes are available in two forms rods and wire. When arc is generated the electrodes get heated up to their melting temperature, thus the metal get solidified in the joint is mixture of base metal and electrode. The electrode is consumed by the arc during the welding process and added the weld joint as filler metal.

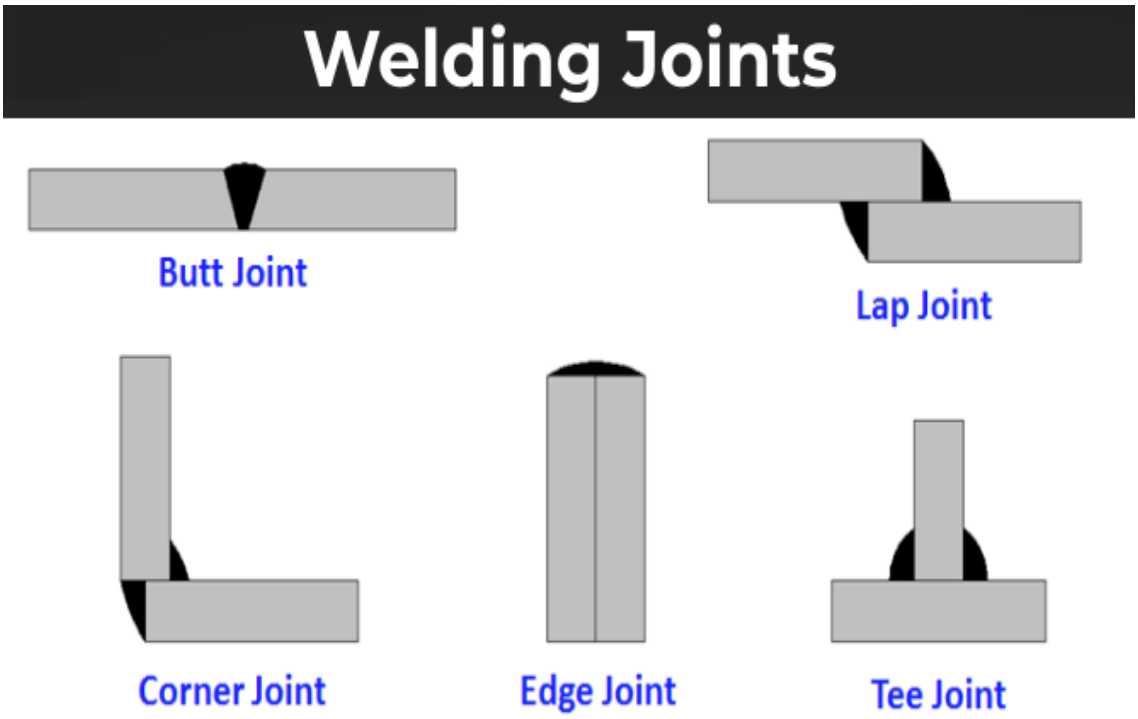
(**b) Non consumable electrodes**:-They are made of tungsten or carbon, which resists melting by arc despite its name a consumables electrode, is gradually depleted during the welding process, analogous to the gradual wearing of a cutting tool in a machining operation.

Welding Positions

The welding positions are classified as follows:

1. Flat position. In this position, the filler metal is deposited from the upper side of the joint with the face of the weld horizontal as shown in fig.
2. Horizontal position. In this position the weld is deposited upon the side of a horizontal and against a vertical surface as shown in fig (b)
3. Vertical position. IN this position the line of welding is in a vertical plane and the weld is deposited upon a vertical surface as shown in fig15.6(c)

Types of Welded Joints



1. Lap Joints. The lap joint is obtained by over lapping the plates and then welding the edges of the plates. These joints are employed on plates having thickness less than 3mm.

2. Butt Joint. The butt joint is obtained by welding the ends or edges of the two plates which are approximately in the same plane with each other shown .In butt welds, the plates edges do not require beveling if the thickness of plates is less than 5mm.On the other hand, if the plates thickness is 5 mm to 12.5mm,.

3. Corner Joint. The corner joints are obtained by joining the edges of two plates whose surfaces are at an angel of approximately 90 to each other. It is used for both light and heavy gauge sheet metal.
4. Edge Joints. The edge joint as, shown in fig.15.3 (b) is obtained by joining two parallel plates. It is economical for plates having thickness less than 6mm.This joints is unsuitable for members subjected to direct tension or bending.
5.T-Joint .The T-joint as, shown in fig15.3(c)is obtained by obtained by joining two plates whose surfaces are approximately at right angle to each other . It is widely used to weld stiffeners in air craft and other thin walled structures, these joints are suitable upto3mm thickness.

Welding Defects:

S. No.	Defects	Reasons
1	Undercut: undercut is like a small notch in the weld interface.	Improper welding technique, excessive welding current, incomplete manipulation of the electrode while depositing the bead.
2	Incomplete fusion; incomplete fusion is a discontinuity in the weld zone.	Improper penetration of the joint, incorrect welding technique, wrong design.
3	Porosity: porosity in large quantity would reduce the strength of the joint.	Porosity in welding is caused by the presence of gases which get entrapped during the solidification processes.
4	Slag inclusion: slag is formed by the reaction with the fluxes and is generally lighter. It would be the chipped off after solidification.	Rapid solidification, insufficient welding heat, improper manipulation of the electrode, high viscosity of weld metal.
5	Hot cracking: hot cracking occurs at high temperature and the size can be very small to be visible.	Less cross-section area of the root bead.

Procedure:
1. Collect tools and material from workshop store.
2. Check work piece for correct dimension, if not bring the dimension within limit by filling. Remove rust from all the surfaces by filling. Make one edge of both work pieces V shape by filling.
3. Now take the work pieces to the welding table.
4. Keep both work pieces by joining V edges on earthing plate.
5. With the help of welding equipments join both the ends. Allow the joint to cool and then remove flux coating and chips by chipping hammer. Clean the surface by wire brush.

Result:-Butt joint as per given dimensions has been made.

Safety Precautions:
1. Heavy leather gloves are to be worn.
2. A hand shield or Welding goggle should be used to protect the face and eyes.
3. An apron should be worn to safeguard the operator's clothes.
4. The space for electric arc Welding should be screened off from rest of the building to safeguard their workmen from glare of the arc.

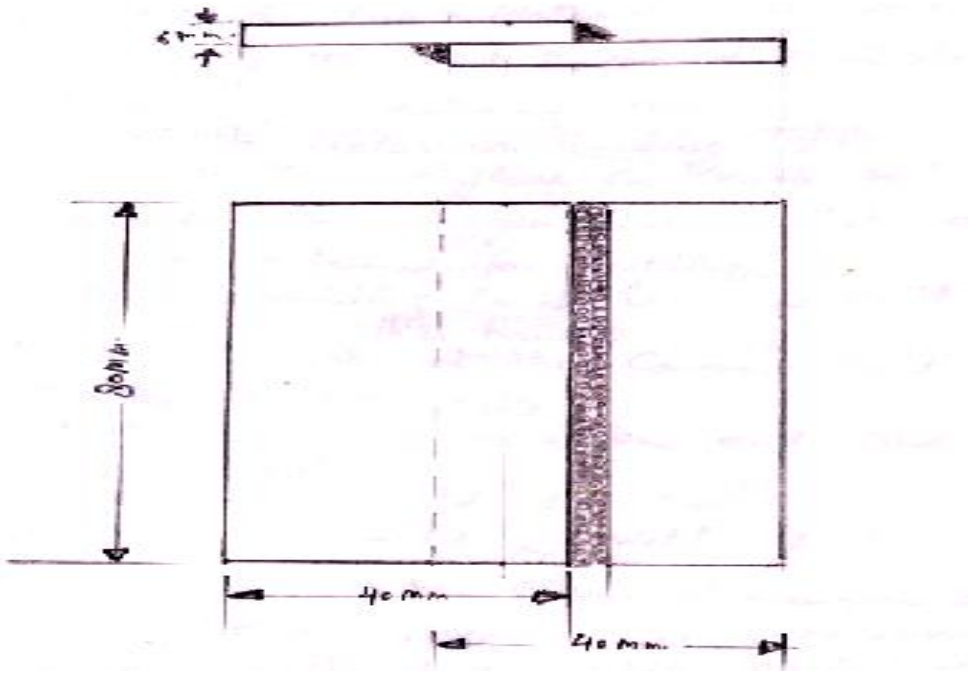
EXPERIMENT NO. 5

Object:-To make lap joint using arc welding on a given work piece as per given dimensions

Tools and Materials:-Mild steel flat, AC Transformer, cables, cable connector, Earthing Plate, electrode holder, electrode, apron , Welding goggle, leather gloves, chipping hammer, chisel, Wire brush

Procedure:
1. Collect tools and material from workshop store.
2. Check work piece for correct dimension, if not bring the dimension within limit by filling.
3. Remove rust from all the surfaces by filling.
4. Make one edge v shape by filling, scribe the lines on work piece as per given dimensions. With the help of welding equipments make lap joint.
5. Allow the joint to cool and then remove flux coating and chips by chipping hammer.
6. Clean the surface by wire brush.

Result:-Lap joint as per given dimensions has been made.



Safety Precautions:

1. Heavy leather gloves are to be worn.
2. A hand shield or Welding goggle should be used to protect the face and eyes.
3. An apron should be worn to safeguard the operator's clothes.
4. The space for electric arc Welding should be screened off from rest of the building to safeguard their workmen from glare of the arc.
5. During gas welding acetylene cylinder pressure should within limit otherwise it may explode.

VIVA VOCE

1. What is welding and types of welding?
2. What are the advantages of welding?
3. What is MMA welding?
4. What are the equipment's used in welding shop?
5. What are types of welding rod?
6. What are the contents of electrode?
7. What are the types of transformers?
8. What are different types of joints?

EXPERIMENT NO. 6

Object:-To perform butt joint on a given work piece as per given dimensions by using Gas welding.

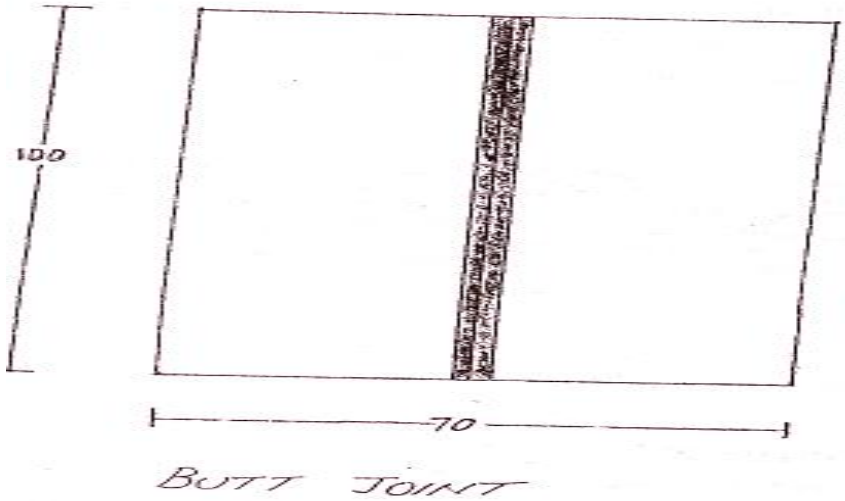
Tools and Materials:-Mild steel flat, AC Transformer, cables, cable connector, Earthing Plate, electrode holder, electrode, apron , Welding goggle, leather gloves, chipping hammer, chisel, Wire brush.

Theory:-

The welding is a process of joining two similar or dissimilar metals by applications of heat with or without application of pressure and addition of filler material. The result is continuity of homogeneous material of the composition and characteristic of two parts, which are being joined together.

Gas Welding

Gas welding is done by burning gas (Acetylene) with air or oxygen in a concentrated flame of high temperature. It can weld most common materials. Equipment is inexpensive, versatile and serves adequately in many job and general repair shops.

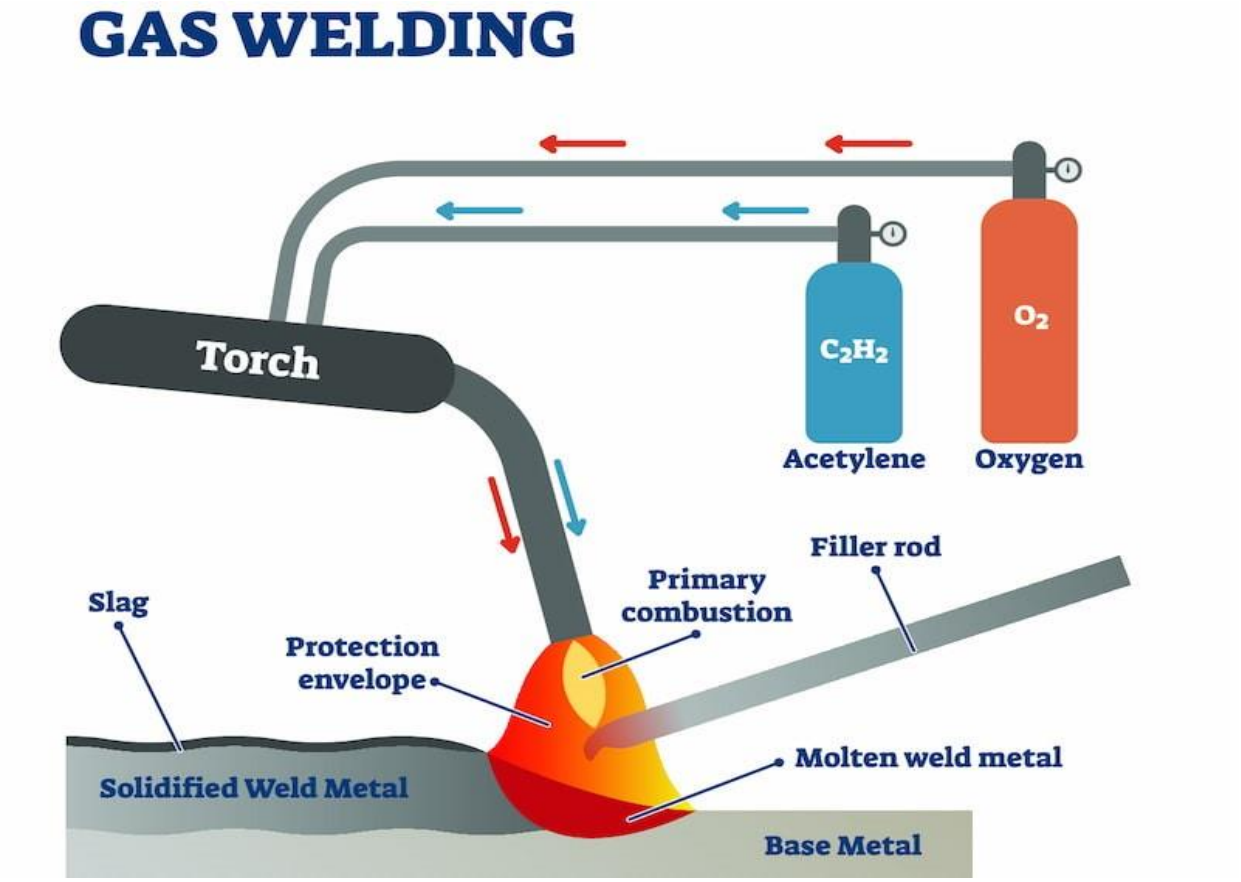


Oxy-Acetylene Welding

It is accomplished by melting the edges or surface to be joined by gas flame and allowing the molten metal to flow together it, thus forming a solid continuous joint upon cooling. The process is particularly suitable for joining metal sheet and plates having thickness of 2-50mm.

Welding equipment (Gas welding)

1. **Welding torch:** this is a tool for mixing oxygen and acetylene in correct proportion and burns the mixture at the end of a tip. These are capable commercially in two general types
   - Equal pressure
   - Injector type



2. **Welding tip:**
It is that portion of the welding apparatus through which the gases pass just prior to their ignition and burning this is a variety of interchangeable welding tips of different size shape and contraction.

3**. Pressure regulator:**
The functions of a pressure regulator are:-
1. To reduce the cylinder pressure to the required rate.
2. To produce a steady flow of gas (GAS volume rate).

4**. Hose and Hose Fitting:**
The hose for welding torches should be strong, durable, non porous and light. The most common method of piping both oxygen and acetylene gas is the reinforced rubber hose, which comes in black, green and red.

5 .Goggles, Gloves and Spark Lighter
Gaggles fitted with colored lances are provided to protect the eyes from harmful heat and ultraviolet and infrared rays. Gloves are used to protect the hands from any injury.

Spark Lighter provides a convenient and instant means for lighting the welding torch.

Gas Welding Technique: In a gas welding the acetylene is first of all turned on by using the control valve on the torch and then it is ignited with a fabrication spark lighter. The flame is adjusted by supplying the oxygen with the oxygen control valve on the torch, piece to be welded are properly

prepared and positioned and the weld is started by preheating and melting a small puddle of molten base metal. In order to obtain proper penetration and to its ends melts at same time as the base metal.

TYPES OF FLAMES:

The combustion of acetylene with pure oxygen at the tip of a gas welding torch takes place in two stages, in the first stage, the carbon from the acetylene combines with oxygen to form carbon monoxide, the hydrogen of the acetylene being freed. The following chemical reaction occurs:

$C_2H_2+O_2=2CO+H_2$

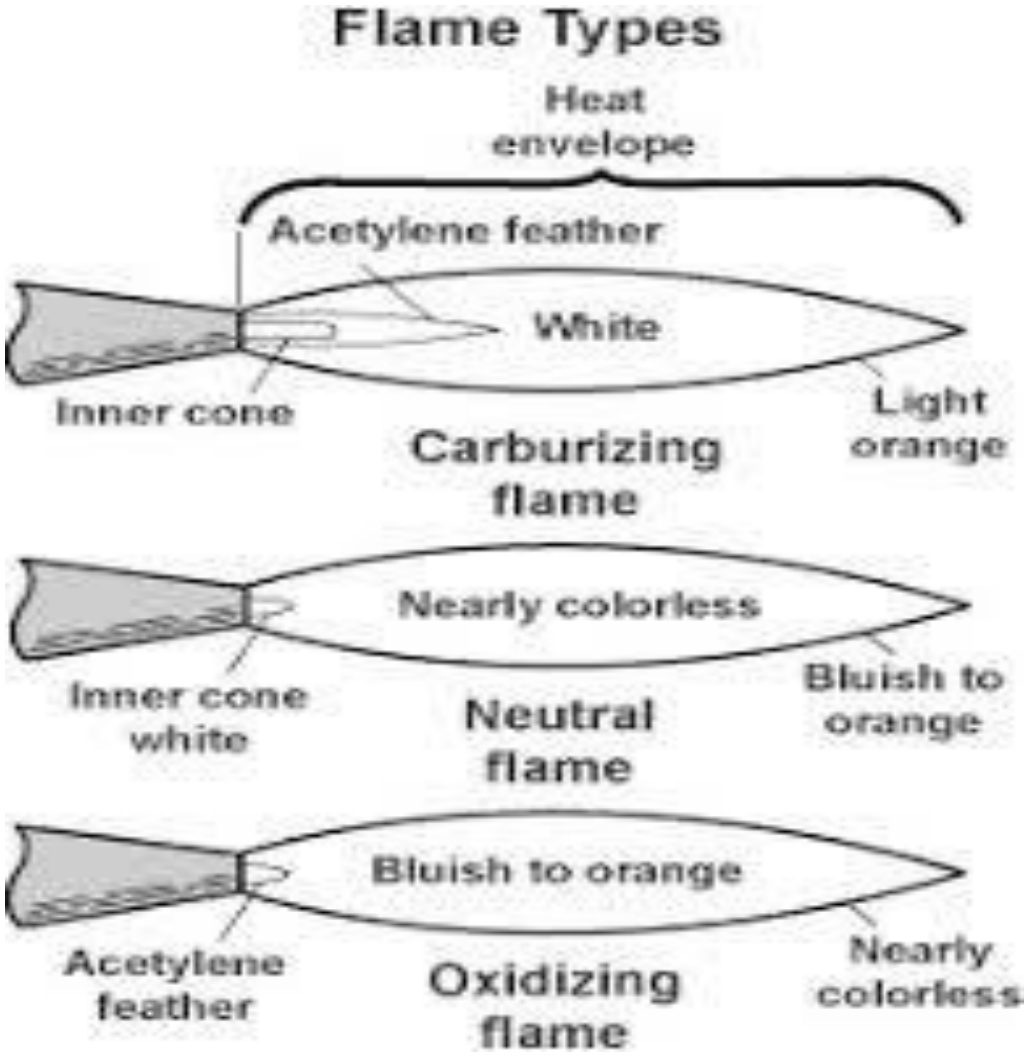
Neutral Flame: this type of flame is obtained by supplying equal volumes of oxygen and acetylene. The most of the oxy- acetylene welding (e.g., welding of steel, cast-iron, copper, aluminum etc.) is done with the neutral flame.

Oxidizing Flame. This type of flame is obtained where there is an excess of oxygen. It is similar to natural flame but the inner cone is less luminous and shorter. It is used for welding brass and bronze.

Reducing or Carburizing Flame. This type of flame are obtained by supplying an excess of acetylene. This flame is used where it is required to keep oxidation to a minimum. It is used for welding of molten metal, a certain alloy steel, many of the non ferrous, hard surfacing materials such as satellite.

Procedure:

1. Collect tools and material from workshop store.
2. Check work piece for correct dimension, if not bring the dimension within limit by filling.
3. Remove rust from all the surfaces by filling. Make one edge of both work pieces V shape by filling.
4 .Now take the work pieces to the welding shop.
5 .Keep both work pieces by joining V edges on earthing plate.
6. With the help of welding equipments join both the ends. Allow the joint to cool and then remove flux coating and chips by chipping hammer. Clean the surface by wire brush.



Result:-Butt joint as per given dimensions has been made.

Safety Precautions:

1. Heavy leather gloves are to be worn.
2. A hand shield or Welding goggle should be used to protect the face and eyes.
3. An apron should be worn to safeguard the operator's clothes.
4. The space for electric arc Welding should be screened off from rest of the building to safeguard their workmen from glare of the arc.

EXPERIMENT NO.7

Object: - To cut a square notch using hacksaw and finish its two side in fitting shop.

Tools &Equipments:

Bench vice surface plate steel scale scriber try square hand neck sow, flat file square file, and drilling m/c drill bit, taps

Material: MS flat (40×40×6) in mm.

THOREY:-

In today's time of automation, most of the production work is carried out through the machine (Manual / Automatic). But is necessary to use some bench working operations to be finishing them or make them accurate.

Various operations of fitting work are follows: -

A) Marking B) Sawing C) Chipping D) Scrapping E) Filing
F) Drilling G) Tapping H) Dieing

We are used following types of tools in fitting shop:-

1) Measuring and marking tools 2)Holding tools 3)Striking tools 4) Cutting tools
5) Drilling and tapping tool.

Measuring and Marking Tools

1. **Try Square:** It is used for checking squareness of two surfaces. It is also used for marking right angle and measuring straightness of surfaces.

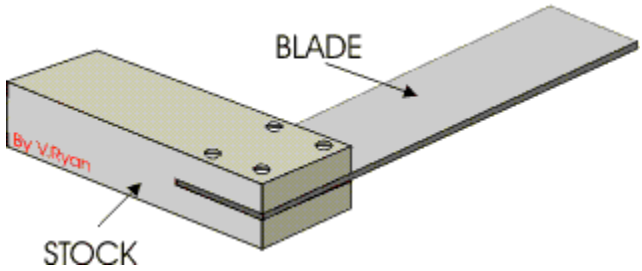
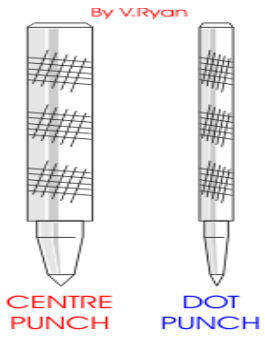


Figure of Try Square

2. **Centre Punch:** The centre punch is made from mild steel with the point hardened and tempered so that it withstands impact with the material it is marking. It is normally used to mark the centre of a hole to be drilled either by hand or on the drilling machine.



3. **Surface Plate: -** It is used for testing of flatness, trueness of the surfaces as well as it is used as marking out table for small jobs. It is made of Grey Cast Iron or Granite.

Figure of Surface Plate

4. **V- Block:** It is used for supporting the rounded job for marking purpose (to mark centre line etc.) and for drilling purpose. It is made of cast iron or steel

Figure of V- Block

5. **Calipers:** Various types of calipers are shown in figure. It is generally used to measure the inside or outside diameters

Figure: Types of calipers

6. Gauges:-

Figure of Radius Gauge

Fig of Filler Gauge

Wire & sheet Gauge

Figure Depth Gauge

Figure of Thread Gauge

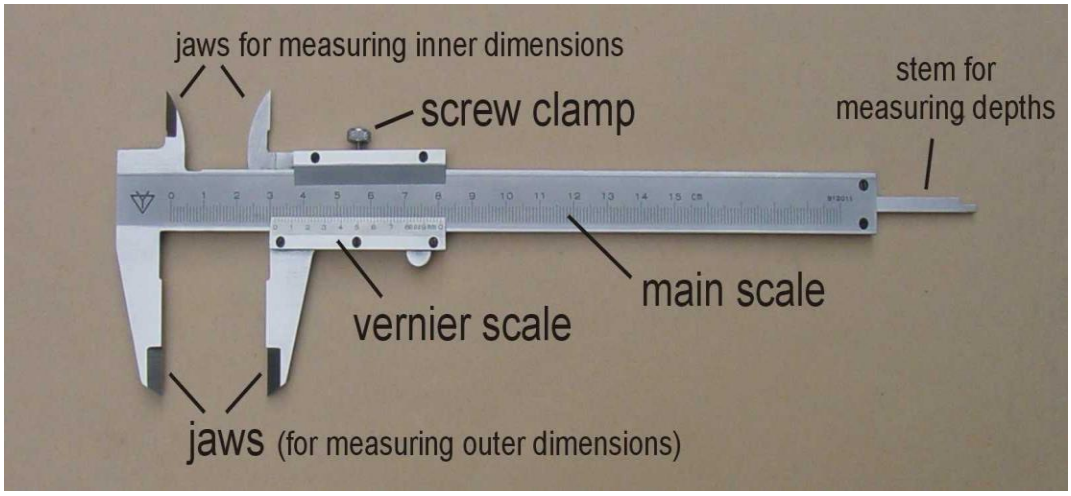
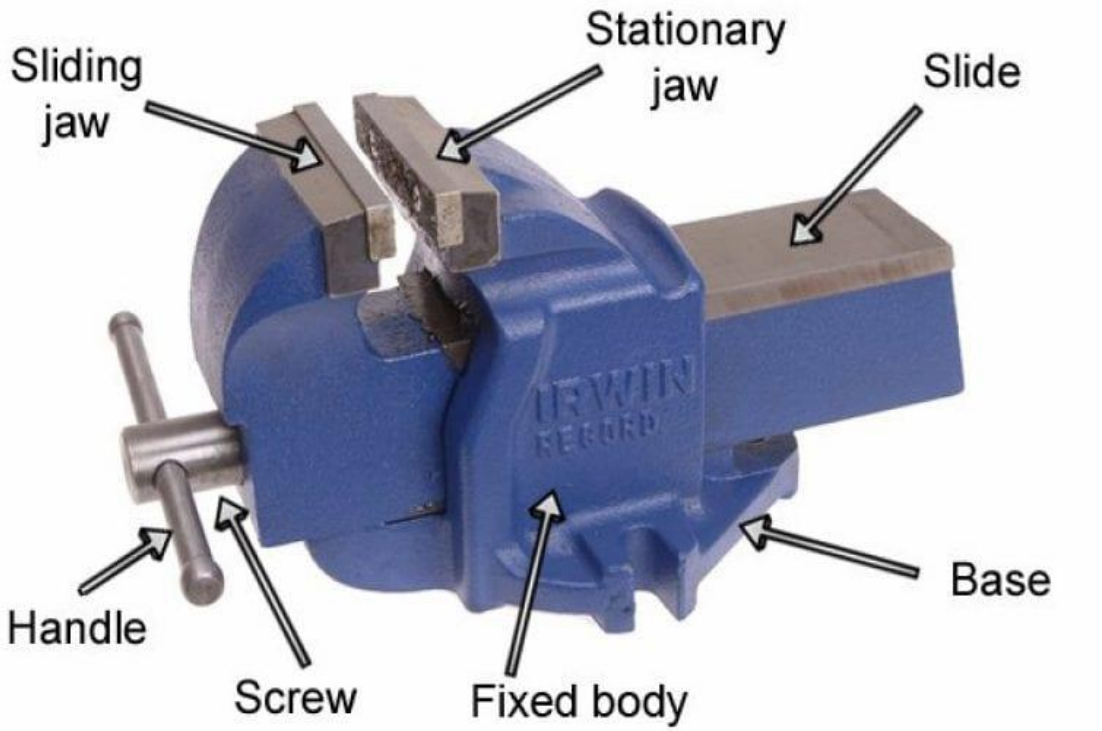


Figure. Vernier Caliper

Figure of Micrometer

Holding Tools:



Striking Tools:

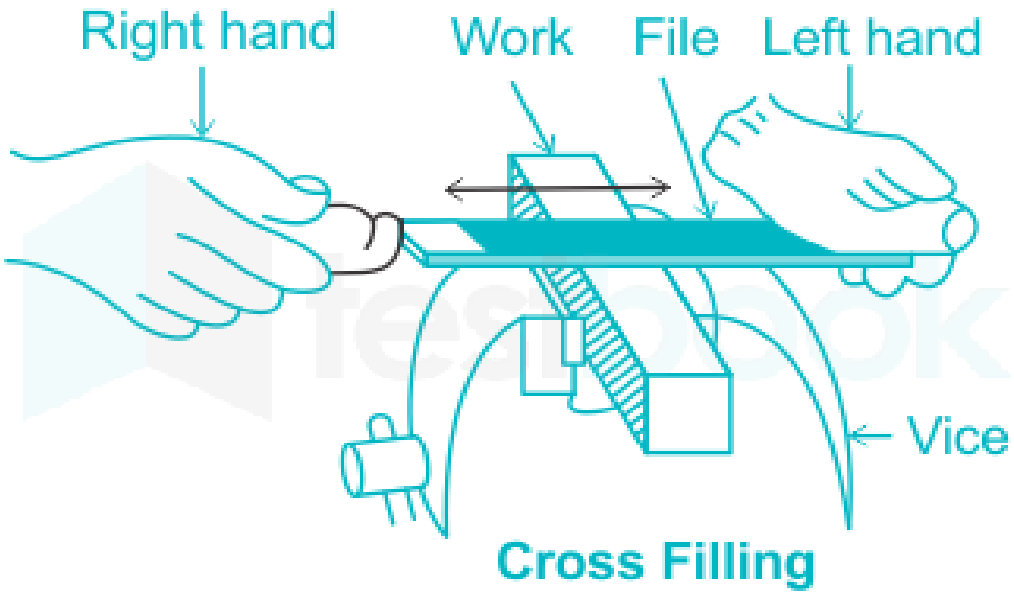
Ball Peen Hammer

Cross Peen Hammer

Claw Hammer

Cutting Tools:

Method of Filing



Files

A file is a hardened piece of high grade steel with slanting rows of teeth it is used to cut smooth or fit metal parts. It cuts all metals expected hardened steel and it cuts only on forward stroke. The teeth are cut on blades which are hardened, tempered.

Classifications:-

Files are classified according to size, cut, teeth, grade shape or cross section of file as discussed.

According Shape of File :

Flat file: flat file is parallel for about two thirds of its length and then tapers in width thickness.

Hand file: hand file has its width parallel throughout but its thickness tapers .both faces are double cut one edge single cut.

Square file: A square file is parallel for two thirds of its length then tapers towards tip. it is double cut on all sides and is used for filling square corners.

Pillar file: A pillar file is similar to hand file but is narrower thicker than hand file it has one or both or uncut edges.

Triangular file: A triangular file has width either parallel through or unto middle &than tapered of the tip. its cross section is triangular and three faces are double cut &edges single cut.

Round file: round file has round cross section .a file with width parallel thought is called round parallel &file with parallel up to middle and then tapering towards tip is called rat file.

Half round: the section of half round file is not a true half circle but is only about one third of circle. Width of the file is either parallel thought or unto middle and then tapered towards tip.

Knife edge file: A knife edge file has a width tapered like a knife blade. It is also tapered towards tip thickness. It is double cut on both flat faces and single cut on both edges.

Warding file: warding file is similar to flat file but it is thinner and parallel on its thickness. It is used for filing narrow slots.

Mill file: A mill file is similar to flat but parallel on both width thickness and have both edges round.

Needle file: The needle file is available in size from 100mm to 200mm of various shapes &cuts.

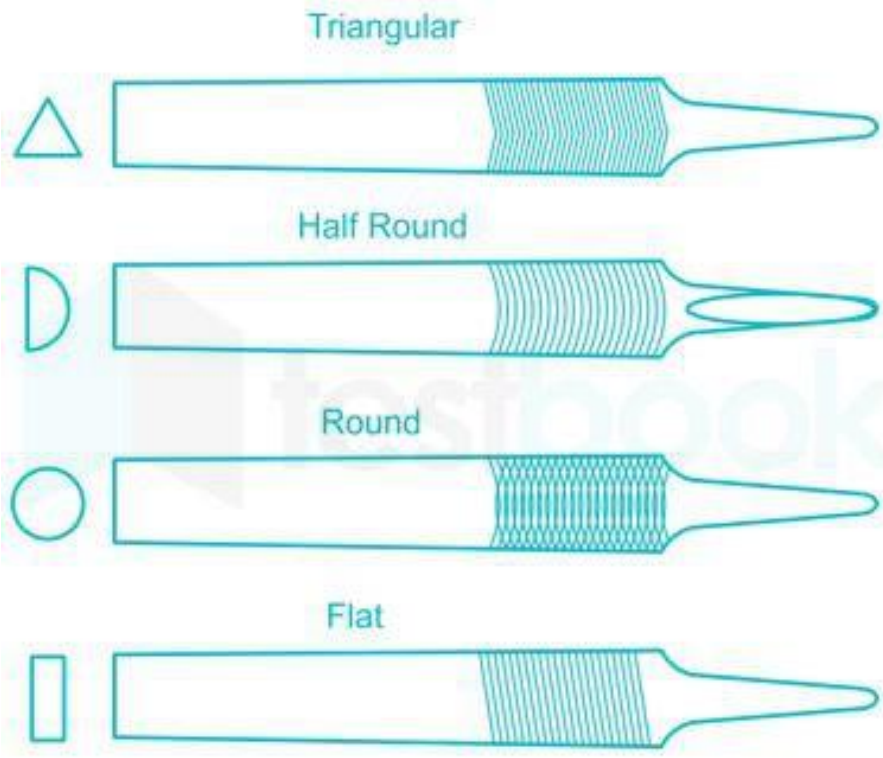


Fig. Type of Files

Figure of Threading tap

Procedure:

1. Collect tools and material from work shop store
2. Check work piece for correct dimensions
3. Hold the work piece in bench vice
4. Remove the burs from edges by filling
5. Squareness& flatness checking by try square
6. T cut the square notch by hand hacksaw
7. Square notch filling by square fill
8. Square &flatness of the square notch checking by try square

Results: -Two side filling, square notch cutting

Precaution:

1. The work piece should be hold sight in vice
2. The files should move horizontally
3. Never use tool without a handle
4. Tools should be kept in a proper case
5. Do not drop the tools
6. After finishing work tools should be cleaned properly

VIVA VOCE

Q. (1) What is fitting?
Q. (2) What are the fitting tools, classified them?
Q. (3) What are the measuring and Marking tools?
Q. (4) What are the cutting tools?
Q. (5) What are the striking tools?
Q. (6) What are the holding tools?
Q. (7) What are the least count of scale, vernier caliper and micrometer?

EXPERIMENT NO.8

Object: - To Drill three holes on p.c.d and tapping fitting shop.

Tools &Equipments:

Bench vice surface plate steel scale scriber try square hand neck sow, flat file square file, and drilling m/c drill bit, taps

Material: MS flat.

Procedure:

1. Marked PCD of work piece &put center punch mark on pcd in put
2. Drill three hole on PCD by drilling m/c and drill bit.
3. Do tapping in the drilled holes by tap.

Results: three holes drilling &tapping operations has been done.

Precaution:

1. Tools should be kept in a proper case
2. Do not drop the tools
3. After drilling work tools should be cleaned properly

VIVA VOCE

Q1.What is tapping?

Q2. What is full form of "PCD" ?

EXPERIMENT NO. 9

Object:- To prepare Aluminum casting with the help of given wooden pattern.

Tools and Materials:- Moulding sand, Aluminum , Mallet, Riddle ,square trowel, pan shape trowel, Moulding board, moulding box, parting of sand, flat rammer, side rammer, strike off bar, spirit level, solid pattern, sprue pin, riser pin, vent rod,slick,lifter, gate cutter.

Theory :-
Introduction

A foundry is a metal casting facility that creates metal objects by melting down metal, pouring molten metal into a mold, and letting it cool to solidify. Foundries specialize in metal casting to create both ornamental and functional objects made of metal.

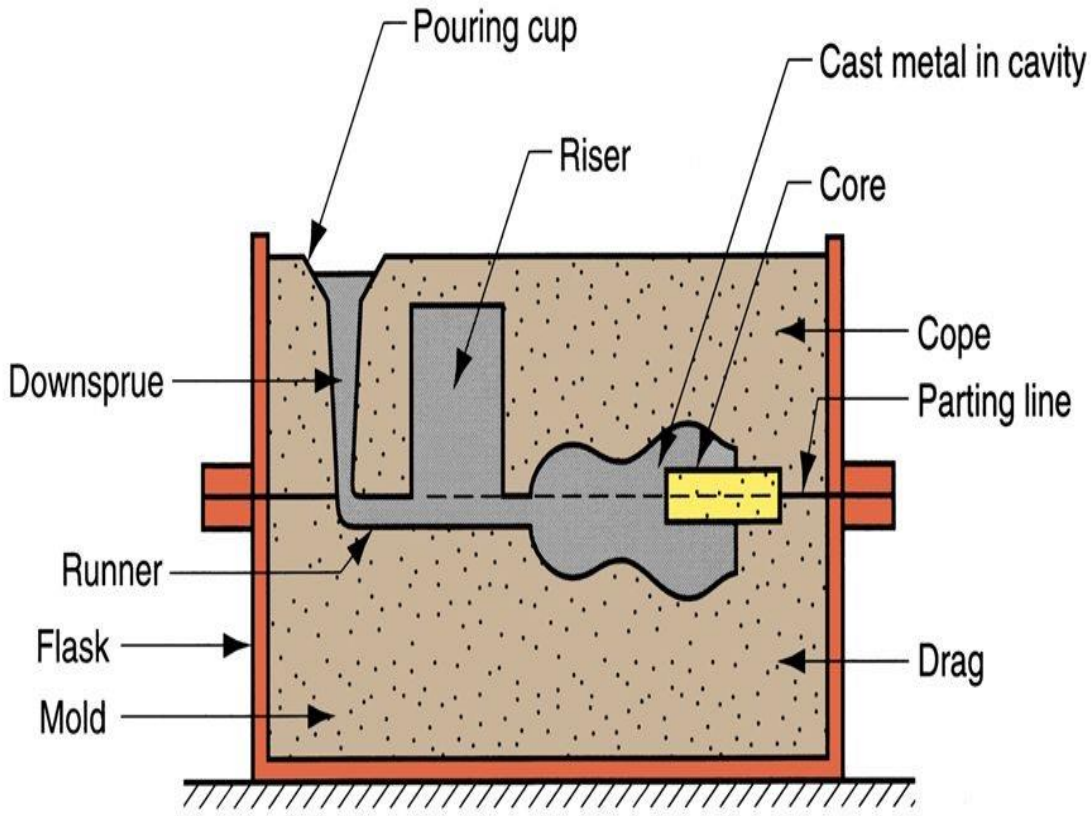


Fig Foundry Process

Pattern
A pattern may be defined is a model or replica of desired casting which when moulded in sand forms an impression called mould.

Pattern Materials

The modern pattern making employs the use of materials that can be easily shaped and are durable. The type of pattern material chosen depends upon the following factors:

a) The design of casting,
b) The number of castings to be produced,
c) The type of casting and moulding process used in foundry, and
d) The degree of accuracy and surface finish required.

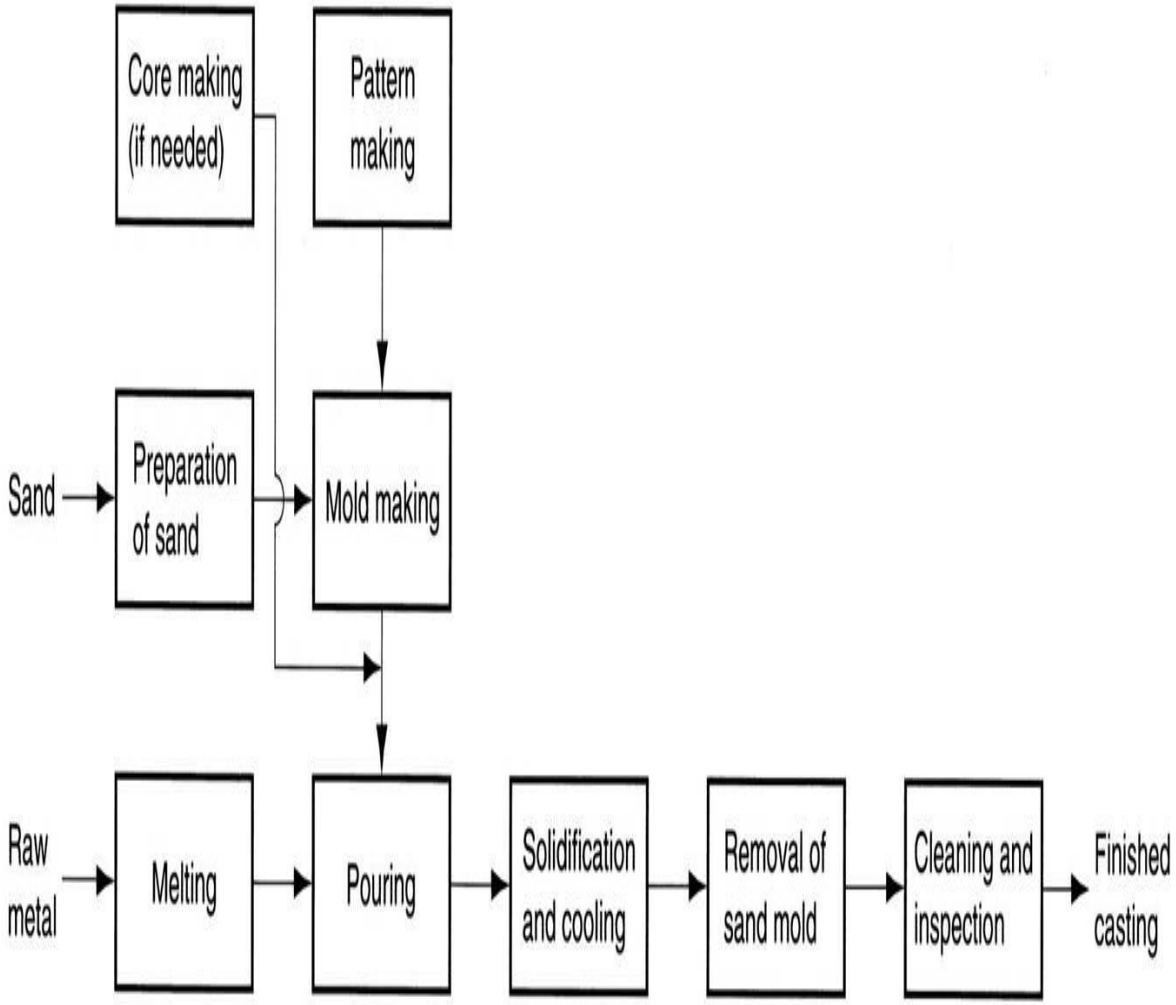
Following are the commonly used materials for pattern making:

1. Wood: It is widely used material for patterns. It is used when small number of castings is to be produced.
2. Metal: When large number of castings is required, the pattern is made of a metal. The metal patterns are more durable, have longer life and produces moulds to a close dimensional accuracy. Following materials are commonly used for pattern making:
Cast Iron, Brass, Aluminum and its alloy, Plaster, Plastics, Wax.

Types of Patterns
The type of pattern to be used for a particular casting depends upon many factor like the bulk of casting, type of moulding process, number of casting required. The following types of patterns are commonly used:

- Solid or Single piece pattern
- Match Plate Pattern
- Split pattern
- Cope and drag pattern
- Loose piece pattern
- Gated Pattern
- Skeleton Pattern

Steps In Process of Casting Process



Foundry Tools

1. **Showel:** It consists of Iron pan with a wooden handle. It can be used for mixing and conditioning of sand.
2. **Trowels:** These are used for finishing flat surfaces and corners inside a mould. Common shapes of trowels are Square and Pan Shape.
3. **Lifter:** A Lifter is a finishing tool used for repairing of the mould and removing the loose sand from the mould.
4. **Riddle:** It is used for ridding of sand to remove the hard pieces from the moulding sand.
5. **Strike off bar:** It is made of wood or iron to strike off the excess sand from the top of a box after ramming. Its one edge made beveled and the surface.
6. **Vent wire:** It is a thin steel rod or wire carrying a pointed edge at one end and a wooden handle of loop at another end. It is used to make small holes for exit of gases and streams during casting.
7. **Draw Spike:** It is a tapered steel rod having a loop or ring at its one end and a sharp point at the other end. It is used for tap and draw pattern from the mould.
8. **Rammers:** Rammers are used for striking the sand mass in the moulding box to pack it closely around the pattern. Generally two types of rammers are used flat and Peen.

9. **Slicks:** They are used for repairing and finishing the mould surfaces and edges after the pattern has been drawn.
10. **Mallet:** It is a like a mallet as that used in sheet metal work. It is used for driving the draw spike in to pattern and hammering of foreign particles of moulding sand.
11. **Swab:** It is fiber brush used for moistening the edges of sand mould which are contact with the pattern.
12. **Bellow:** It is used to blow the loose unwanted sand from the surface of mould.
13. **Sprue pin:** It is a tapered rod of wood or Iron which is embedded in the sand and later withdrawn to produce a hole called runner.
14. **Moulding Box:** The moulding boxes are used in sand mouldling may be made of wood or steel. They consist of two parts. The upper part is called Cope and lower part is called Drag.
15. **Moulding board:-** The moulding board is to provide support moulding box or pattern during the mould making. It is made by wood.
16. **Crucibles:** They are made of refractory material and are similar in shape to the ladles. They are used for metal melting.
17. **Electric Furnace:** Furnace is used to provide heating material up their pour point/ Melting point.

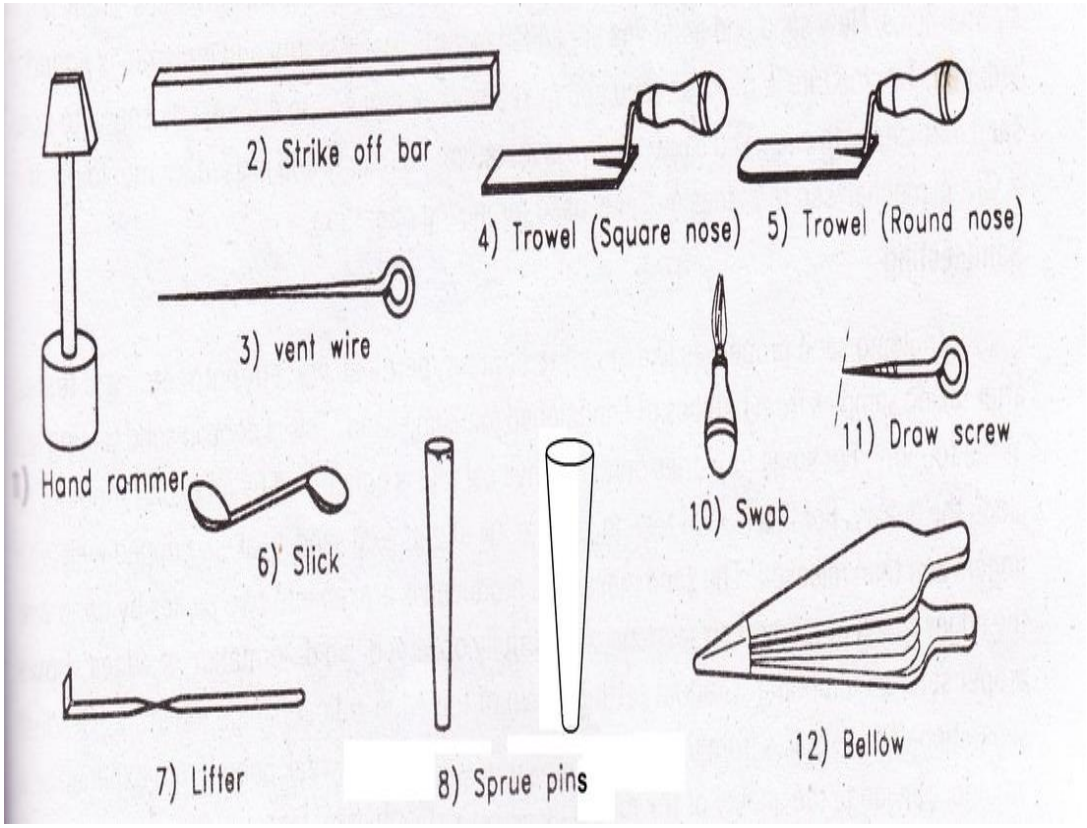


Fig. : - Foundry Tools

Properties of Moulding Sands

Strength: The mould's ability to maintain its shape and resists erosion caused by the molten metal. It depends on grain shape, adhesive qualities of the binder.

Permeability: The capacity of the mould to allow hot air and gases from the casting operation to pass through the voids in the sand.

Thermal Stability: The ability of the sand at the surface of the mould cavity to resist cracking and buckling upon contact with the molten metal.

Collapsibility: The ability of the mould to give way and allow the casting to shrink without cracking the casting. It also refers to the ability to remove the sand from the casting during cleaning.

Reusability: The sand from the broken mould be reused to make other moulds.

Constituents of Moulding Sand

The principal constituents of moulding sand are:

1. Silica sand
2. Binder
3. Additives, and
4. Water

(A) Silica Sand: Silica Sand (SiO_2) contains water for a long time and is suitable for a wide working range. It helps to patching and finishing operations of the mould.

(B) Binders: The purpose of adding a binder to the moulding sand is to impart it sufficient strength and cohesiveness so as to enable it to retain its shape after the mould has been rammed and the pattern withdrawn.

(C) Additives: Additives are those materials which are added to moulding sand to improve upon some of the existing properties or to impart certain new properties to it. The commonly used Coal dust.

(D) Water: The clay content added to the foundry sand will not give the required strength and bond until a suitable quantity of water is added to it. This quantity of water varies from 2 to 8 percent according to different requirements.

Mould Classifications

Moulds are classified as follows:

1. Sand Moulds: Depending upon the type of sand used, there are different types of moulds, namely,

Greensand : Greensand moulds are made of a mixture of sand, clay, and water, the word 'green' referring to the fact that the mould contains moisture at the time of pouring, Greensand moulds possess sufficient strength for most applications, good collapsibility, good permeability, and good reusability and are the least expansive of the moulds..

Dry sand moulds: A dry-sand mould is made using organic binders rather than clay, and the mould is baked in a large oven at temperatures ranging from 20°C to 316°C.

Skin dried mould: In a skin-dried mould, the advantages of a dry-sand mould are partially achieved by drying the surface of a greensand mould to a depth of 0.5 to 1 inch at the mould cavity surface, using torches, heating lamps, or other means.

Defects in Castings

The defects in a castings may be due to pattern moulding box equipments moulding sand cores getting system or molten metal. Some of the defects &their reasons are discussed below.

Mould shift: it results in mismatching of the top & bottom parts of casting. Misalignment of pattern parts due to worn or damaged pattern.
Core shift: It is an abnormal variation of dimensions which are dependent on core position misalignment of cores in assembling cored moulds by using incorrect size of chaplet.
Swell: It is an enlarged of the mould cavity by molten metal pressure resulting in localized or general enlarged of casting. Insufficient ramming of sand, insufficient weighting of mould during casting pouring of molten metal too rapidly or too hard.
Sand wash: It usually occurs near ingrates as rough lamps on surfaces of casting sand that has been washed away appears on upper surfaces of castings as rough holes or depression.
Shrinkage: It is crack in the casting or dishing on surfaces of castings which results from unequal contraction of metal during solidification ,improper location size of gates ,inadequate risers, lack of directional solidification incorrect metal composition incorrect pouring temperatures.
Hot tear: It is an internal or external ragged discontinuity in the metal casting resulting from hindered contraction occurring just after metal has solidified ,abrupt change in section inadequate filleting of inside corners.
Sand blow or blow hole: It is an excessively smooth depression on the outer surface of casting this defect is also called blow holes, high moisture content in moulding sand, low permeability of sand, hard ramming of sand defective getting system.
Core blow: It is an excessively smooth depression on the inner surface of cored cavity or gas pocket immediately above cored cavity.
Scabs: These are patches of sand on the upper surfaces of casting this defects is due to the following reasons, uneven ramming of sand, slow or intermittent of metal.

Result:- Aluminum casting as per given wooden pattern has been prepared.

Safety Precautions:

1. Do not wear gauntlet/gloves.
2. Do not permit water to collect on the floor around a furnace.
3. Do not throw dump/wet metal into furnace.
4. Cover the floor under cupola by a thick layer of sand to avoid splashing.
5. Blow air through a crucible furnace before start.
6. Store crucible in warm dry place.
7. Thoroughly heat the ladles before use.
8. Do not move in backward direction while pouring molten metal.
9. Keep feet at a safe distance from the mould.
10. Do not place face directly over runners or risers while pouring.

VIVA VOCE

Q. (1) What is foundry?
Q. (2) What is pattern and types of pattern?
Q. (3) What are foundry tools?
Q. (4) What are types of moulding sand?
Q. (5) What are the contents of moulding Sand?
Q. (6) What are the properties of moulding sand?
Q. (7) What is composition of green sand?
Q. (8) What are the types of furnace?
Q. (9) What is melting point of aluminum?
Q. (10) What are the material for pattern making?

EXPERIMENT NO.10

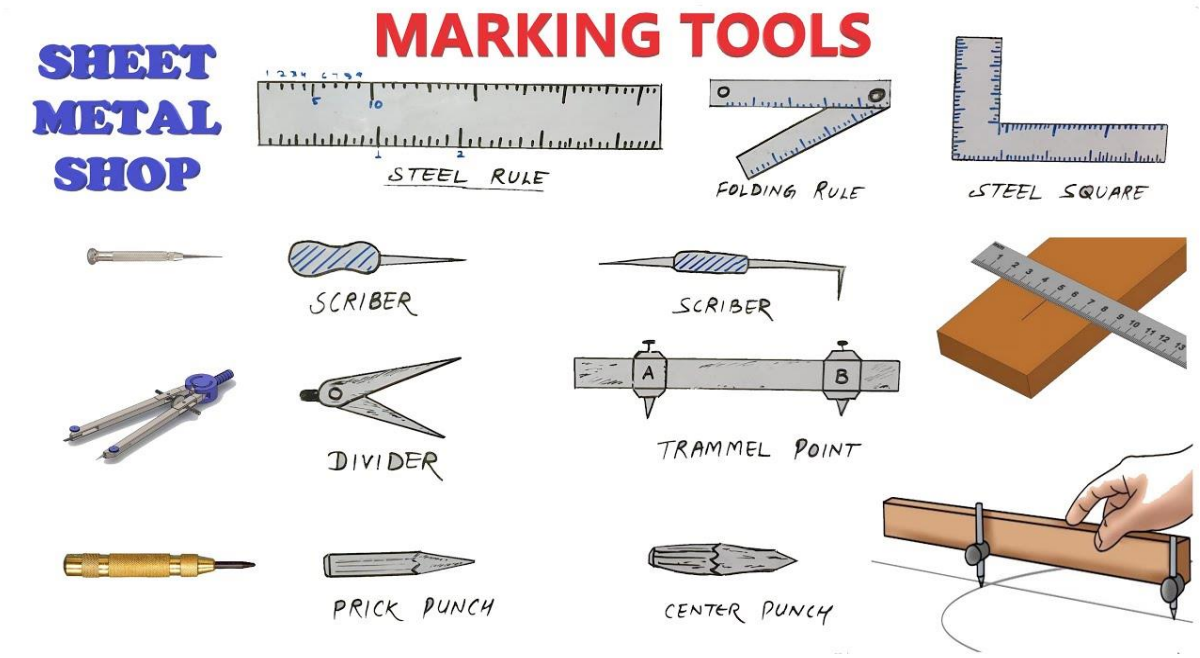
Object: - To prepare funnel as per drawing in sheet metal shop.

Tools & Equipment's: - Mallet, hand shear, bench shear, grooving and riveting tool, metal sheet, soldering equipment

Material: - GI Sheet.

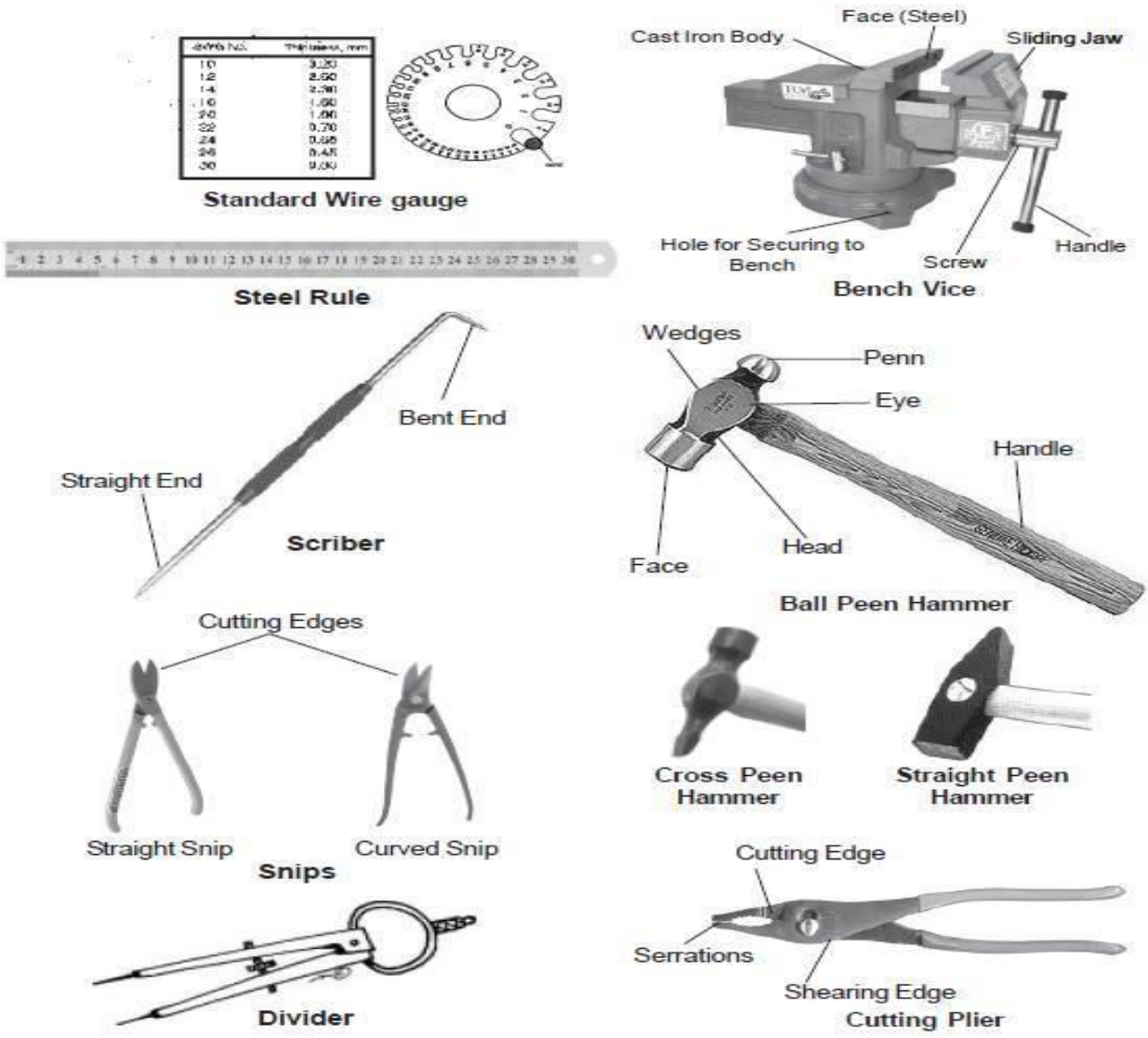
Introduction:
Many engineering and house hold articles such as boxes, cans, funnels, ducts etc., are made from a flat sheet of metals. These process being known as tin smithy. For this, the development of the article is first drawn on the sheet metal then cut and folded to form the required shape of the article. The edge of the articles are then secured through welding, brazing, soldering, riveting etc., A sheet of soft steel which is coated with molten zinc is known as galvanized iron. The zinc coat forms a coating that resists rust, improves the appearance of the metal and permits it to be soldered with greater care.

Hand tools:- The common hand tools used in sheet metals work are steel rule, usually of 60 cm length, Vise gauge, dot punch, scriber, trammels, ball peen hammer, and straight peen hammer, cross peen hammer, mallets, snips and soldering iron.



Trammels:- Sheet metals layouts require marking of arcs and circles. This may be done by using the trammels..
Wire gauge:- The thickness of the sheet metal is referred in numbers known as standard wire gauge (SWG). The gaps in the circumstance of the gauge are used to check the gauge number.
Bench shears:- Sheet metal may be cut by shearing action. In this the force is applied through a compound lever, making it possible to cut sheet metal up to 4mm thick. The chopping hole can shear a mild steel rod up to 10mm diameter.
Snips:- Snips are hand shears, varying in length from 200mm to 600mm. 200mm to 250mm being the commonly used. The straight lines are curved snips or bent snips are for trimming along inside curves.

Hammers:- Ball peen hammer has a cylindrical slightly curved face and a ball head straight peen and similar to the cross peen, but it is positioned paralleled to the handle which can be used conveniently for certain operations of folding. **Stakes:-** Stakes are nothing but anvils, which are used as supporting tools and to form seam, bend, rivet sheet metal objects.



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Sheet Metal Joints Technique

Riveting:- Rivets are used to fasten two of more sheets of metal together. It is the common practice to use the rivets of the same material as that of the sheets having fastened.

Sheet metal screws:- These are used in sheet metal work to join and install duct work for ventilation air conditioning etc.

Soldering:- Soldering is one method of joining two pieces of metal with an alloy that melts at a lower temperature than the metals to be joined for a good job. Solder is made of tin and lead in equal proportions..

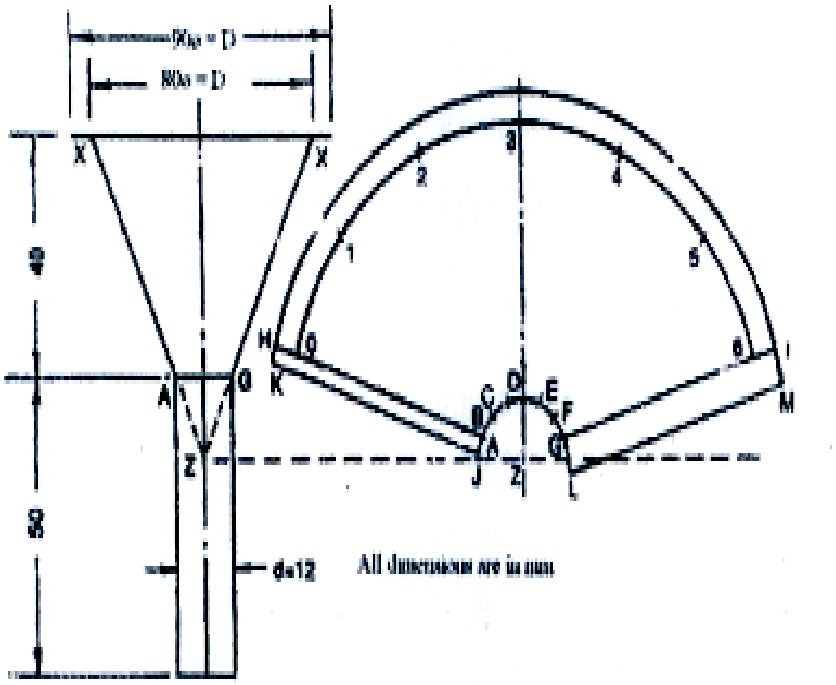
Soldering iron:- Soldering requires a source of heating. A common method of transmitting heat of the metal surfaces is by using a soldering iron.

Procedure for funnel: ¬

1) Draw the elevation on full scale ¬ Complete the cone by extending the lines A and G ¬ Choose a point Z and draw curves with Z as a center, and ZA and ZX as radius

2) Draw the vertical line Z3, meeting the internal curve at D, and external curve at 3 ¬ Starting from D mark lengths DC, CB, BA, DE, EF and FG, each equal to nd/6. ¬ Again starting from 3 mark length 3-2, 2-1, 1-0, 3-4, 4-5 and 5-6, each equal to πd/6. (D and d are major and minor diameters)

3) Draw another curve with Z as a center and ZX+5 mm as radius . ¬ Joint AO and G6 and extend it to cut the outer curve at points H and I, respectively. ¬ Provide a margin of 5 mm on one side, and 10 mm on another side for joint. ¬ Cut out the required portion and form the conical portion. ¬ Make the bottom half of the funnel.



Result: - Funnel is prepared as per the required dimensions.

Safety precautions: -

1. For marking purpose use scriber only. Do not use pencil or pen.
2. Sufficient care is to be taken while cutting and folding of G.I. sheet.
3. Remove the waste pieces immediately from the work place.

EXPERIMENT NO.11

Object: Demonstration of Brazing, Soldering & Gas Cutting

Brazing

Brazing is a joining process whereby a non-ferrous filler metal or alloy is heated to melting temperature above 450°C (842°F), or, by the traditional definition that has been used in the United States, above 800°F (425)°C and distributed between two or more close-fitting parts by capillary action. At its liquid temperature, the molten filler metal and flux interacts with a thin layer of the base metal, cooling to form an exceptionally strong, sealed joint due to grain structure interaction.

Advantages of Brazing

1. The lower temperature of brazing and brass-welding is less likely to distort the work piece, significantly change the crystalline structure (create a heat affected zone) or induce thermal stresses.
2. The lower temperature associated with brazing vs. welding can increase joining speed and reduce fuel gas consumption.
3. Brazing can be easier for beginners to learn than welding.
4. For thin work pieces (e.g., sheet metal or thin-walled pipe) brazing is less likely to result in burn-through.
5. Brazing can also be a cheap and effective technique for mass production. Components can be assembled with preformed plugs of filler material positioned at joints and then heated in a furnace or passed through heating stations on an assembly line. The heated filler then flows into the joints by capillary action.

Soldering

Soldering is the process in which two metals are joined together by means of a third metal or alloy having a relatively low melting point. Soft soldering is characterized by the value of the melting point of the third metal or alloy, which is below 450°C. The third metal or alloy used in the process is called solder.

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Applications

1. Assembling electronic components to printed circuit boards (PCBs).
2. Making permanent but reversible connections between copper pipes in plumbing systems.
3. Joints in sheet-metal objects such as food cans, roof flashing, rain gutters and automobile radiators have also historically been soldered.