A Laboratory Manual for

Workshop/Manufacturing Practices (3110012)

B.E. Semester 1/2 (Mechanical)

Directorate of Technical Education, Gandhinagar, Gujarat

Vision of the DTE

- To provide globally competitive technical education;
- Remove geographical imbalances and inconsistencies;
- Develop student friendly resources with a special focus on girls' education and support to weaker sections;
- Develop programs relevant to industry and create a vibrant pool of technical professionals.

Vision of the Institute

Mission of the Institute

MECHANICAL ENGINEERING DEPARTMENT

Vision of the Department

Mission of the Department

Lukhdhirji Engineering College, Morbi

Certificate

This is to certify that Mr./Ms. _____ _____ Enrollment No. _____ of B.E. Semester _____ Mechanical Engineering of this Institute (GTU Code: _____) has satisfactorily completed the Practical / Tutorial work for the subject **Workshop/Manufacturing Practices (3110012)** for the academic year 2023-24.

Place: _____

Date: _____

Name and Sign of Faculty member

Head of the Department

Preface

Main motto of any laboratory/practical/field work is for enhancing required skills as well as creating ability amongst students to solve real time problem by developing relevant competencies in psychomotor domain. By keeping in view, GTU has designed competency focused outcome-based curriculum for engineering degree programs where sufficient weightage is given to practical work. It shows importance of enhancement of skills amongst the students and it pays attention to utilize every second of time allotted for practical amongst students, instructors and faculty members to achieve relevant outcomes by performing the experiments rather than having merely study type experiments. It is must for effective implementation of competency focused outcome-based curriculum that every practical is keenly designed to serve as a tool to develop and enhance relevant competency required by the various industry among every student. These psychomotor skills are very difficult to develop through traditional chalk and board content delivery method in the classroom. Accordingly, this lab manual is designed to focus on the industry defined relevant outcomes, rather than old practice of conducting practical to prove concept and theory.

By using this lab manual students can go through the relevant theory and procedure in advance before the actual performance which creates an interest and students can have basic idea prior to performance. This in turn enhances pre-determined outcomes amongst students. Each experiment in this manual begins with competency, industry relevant skills, course outcomes as well as practical outcomes (objectives). The students will also achieve safety and necessary precautions to be taken while performing practical.

This manual also provides guidelines to faculty members to facilitate student centric lab activities through each experiment by arranging and managing necessary resources in order that the students follow the procedures with required safety and necessary precautions to achieve the outcomes. It also gives an idea that how students will be assessed by providing rubrics.

Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops. Irrespective of branch, the use of workshop practices in day to day industrial as well domestic life helps to dissolve the problems.

Utmost care has been taken while preparing this lab manual however always there is chances of improvement. Therefore, we welcome constructive suggestions for improvement and removal of errors if any.

Practical – Course Outcome matrix

Course Outcomes (COs):

CO-1 Understand various manufacturing processes in machine shop and perform basic operations of welding, fitting, smithy and carpentry work a) perform basic operations of welding, fitting, smithy and carpentry work, b) Explain various manufacturing processes in machine shop
drawing.

CO-2 Discuss application of plumbing fitting, masonry items and about plastic molding and glass cutting for various engineering application

CO-3 different electrical quantities and trouble shoot electrical and electronics appliances.

CO-4 experiments with various kits such as Raspberry and Arduino for embedded system development

CO-5 Use basic commands of computer operating systems

Sr. No.	Objective(s) of Experiment	CO 1	CO 2	CO 3	CO 4	CO 5
1.	To study different instruments/tools used in fitting shop and make a job as per given drawing.	√				
2.	To study different instruments/tools used in carpentry shop and make a job as per given drawing.	√				
3.	To study different instruments/tools used in tin smithy shop and make a job as per given drawing by application of different types of sheet metal joints.	√				
4.	To study the different application of plumbing fitting for various engineering application.		√			
5.	To study different instruments/tools used in welding shop and make a job as per given drawing by application of different types of metal joints.	√				
6.	To study the different application of various basic machine tools and its application.	√				

Industry Relevant Skills

The following industry relevant competency are expected to be developed in the student by undertaking the practical work of this laboratory.

1. Student must be able to identify the tools and it usage.
2. Student must be able to use the proper tool to have finished job as per given drawing.

Guidelines for Faculty members

1. Teacher should provide the guideline with demonstration of practical to the students with all features.
2. Teacher shall explain basic concepts/theory related to the experiment to the students before starting of each practical.
3. Involve all the students in performance of each experiment.
4. Teacher is expected to share the skills and competencies to be developed in the students and ensure that the respective skills and competencies are developed in the students after the completion of the experimentation.
5. Teachers should give opportunity to students for hands-on experience after the demonstration.
6. Teacher may provide additional knowledge and skills to the students even though not covered in the manual but are expected from the students by concerned industry.
7. Give practical assignment and assess the performance of students based on task assigned to check whether it is as per the instructions or not.
8. Teacher is expected to refer complete curriculum of the course and follow the guidelines for implementation.

Instructions for Students

1. Students are expected to carefully listen to all the theory classes delivered by the faculty members and understand the COs, content of the course, teaching and examination scheme, skill set to be developed etc.
2. Students shall organize the work in the group and make record of all observations.
3. Students shall develop maintenance skill as expected by industries.
4. Student shall attempt to develop related hand-on skills and build confidence.
5. Student shall develop the habits of evolving more ideas, innovations, skills etc. apart from those included in scope of manual.
6. Student shall refer technical magazines and data books.
7. Student should develop a habit of submitting the experimentation work as per the schedule and she/he should be well prepared for the same.

Common Safety Instructions

1) **It is compulsory to wear apron and safety shoes in workshop.**
2) **Don't wear watch, ring, and chains like loose items while working in workshop.**
3) **Don't work on any machines without permission and guidance of instructor/faculty.**
4) **While working on grinding/welding machines always use safety goggles.**
5) **Maintain the discipline while working in workshop.**
6) **After working clean the work space area and oil it if required. Take the help of instructor for guidance.**
7) **First aid box is available, asked for same and used it for primary treatment in case of injury.**
8) **In case of serious injury inform immediately to concerned present in workshop to take action in time**.
9) **Bags should not be brought into a workshop as people can trip over them.**
10) **Always be patient, never rush in the workshop.**
11) **Report any damage to machines/equipment as this could cause an accident.**

Lukhdhirji Engineering College, Morbi
Mechanical Engineering Department

WORKSHOP SAFETY RULES

1. Wear proper workshop dress having the half sleeve shirt.
2. Always wear shoes. Wear safety goggles, hand gloves, leather apron when Welding/ Grinding operation is carried out.
3. Maintain discipline & respect at work and walk within the prescribed area. Do not wander in workshop without work.
4. The students are not permitted to touch or operate any machines, tools without permission from the faculty/lab assistant/instructor.
5. Do not play with tools and machines.
6. Do not keep or handle the tools carelessly.
7. Do not carry the tools in your pocket.
8. Do not tamper with electrical connections.
9. Do not operate any machine without permission.
10. Use a proper tool for proper work.
11. Do not rub finger at any sharp edges during sheet metal work.
12. Do not go or wander far when machine is on work.
13. Always keep working area neat and clean.
14. Always use hair brush for removing chips or metal dust.
15. Use proper fire extinguisher when there is Fire.
16. Do take care when forge sparking and hot working in smithy.
17. Report immediately to the instructor in case of any injury and use proper first aid available.
18. Always perform job work with happy mood.

Index
(Progressive Assessment Sheet)

Sr. No.	Objective(s) of Experiment	Page No.	Date of performance	Date of submission	Assessment Marks	Sign. of Teacher with date	Remarks
1	To study different instruments/tools used in fitting shop and make a job as per given drawing.						
2	To study different instruments/tools used in carpentry shop and make a job as per given drawing.						
3	To study different instruments/tools used in tin-smithy shop and make a job as per given drawing by application of different types of sheet metal joints.						
4	To study the different application of plumbing fitting for various engineering application.						
5	To study different instruments/tools used in welding shop and its various types with applications.						
6	To study the different application of various basic machine tools and its application.						
Total							

* Units *

SI base units				
Name	**Symbol**	**Quantity**	**Expression in terms of other units**	**Expression in terms of SI base units**
Newton	N	Force, Weight	$m \cdot kg/s^2$	$m \cdot kg \cdot s^{-2}$
joule	J	Energy, Work, Heat	$N \cdot m$	$m^2 \cdot kg \cdot s^{-2}$
watt	W	Power	J/s	$m^2 \cdot kg \cdot s^{-3}$
Pascal	Pa	Pressure, Stress	N/m^2	$m^{-1} \cdot kg \cdot s^{-2}$

Some Important Derived Units			
Name	**Symbol**	**Quantity**	**Expression in terms of SI base units**
Square metre	m^2	**area**	m^2
Cubic metre	m^3	**volume**	m^3
Metre per second	$m \cdot s^{-1}$	**speed, velocity**	$m \cdot s^{-1}$
Metre per second squared	$m \cdot s^{-2}$	**acceleration**	$m \cdot s^{-2}$
Radian per second	$rad \cdot s^{-1}$	**angular velocity**	s^{-1}
Newton second	$N \cdot s$	**momentum, impulse**	$kg \cdot m \cdot s^{-1}$
Newton metre second	$N \cdot m \cdot s$	**angular momentum**	$kg \cdot m^2 \cdot s^{-1}$
Newton metre	$N \cdot m$	**torque, moment of force**	$kg \cdot m^2 \cdot s^{-2}$
Kilogram per cubic metre	$kg \cdot m^{-3}$	**density, mass density**	$kg \cdot m^{-3}$
Cubic metre per kilogram	$kg^{-1} \cdot m^3$	**specific volume**	$kg^{-1} \cdot m^3$
Mass Moment of Inertia	$kg \cdot m^2$	**Mass Moment of Inertia**	$kg \cdot m^2$

Experiment No: 1
To study different instruments in fitting shop.

Date:

Competency and Practical Skills:

Relevant CO: CO-1

Objectives: Study of formation by cutting & filling the metals.

Equipment/Instruments: Hand hacksaw, Hammer, Drill, Files, machine vice

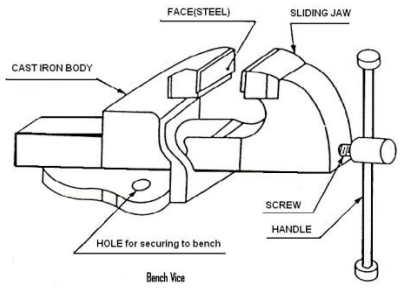
Theory:

Tool used in Fitting Shop:

Tools used in fitting shop are classified as follows:

- Holding Tools
- Marking and Measuring Tools
- Cutting Tools
- Miscellaneous Tools
- Holding Tools

Bench vice

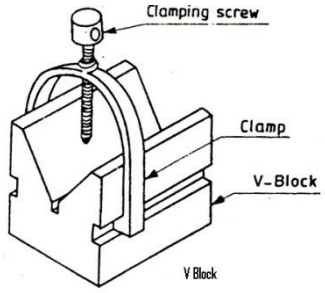


The bench vice is a work holding device. It is the most commonly used vice in a fitting shop. It is fixed to the bench with bolts and nuts. The vice body consists of two main parts, fixed jaw and movable jaw. When the vice handle is turned in a clockwise direction, the sliding jaw forces the work against the fixed jaw. Jaw plates are made of hardened steel. Serrations on the jaws ensure a good grip. Jaw caps made of soft material are used to protect finished surfaces, gripped in the vice. The size of the vice is specified by the length of the jaws. The vice body is made of cast Iron which is strong in compression, weak in tension and so fractures under shocks and therefore should never be hammered.

V – Block

V-block is rectangular or square block with a V-groove on one or both sides opposite to each other. The angle of the 'V' is usually 90^0. V-block with a clamp is used to hold cylindrical work securely, during layout of measurement, for measuring operations or for drilling for this the bar

is faced longitudinally in the V-Groove and the screw of V-clamp is tightened. This grip the rod is firm with its axis parallel to the axis of the v-groove.

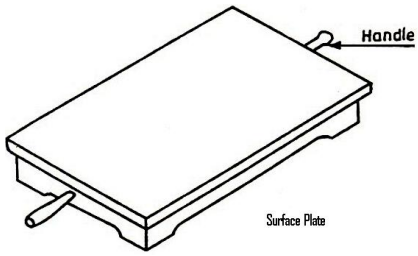


C - Clamp

This is used to hold work against an angle plate or v-block or any other surface, when gripping is required. Its fixed jaw is shaped like English alphabet 'C' and the movable jaw is round in shape and directly fitted to the threaded screw at the end .The working principle of this clamp is the same as that of the bench vice.

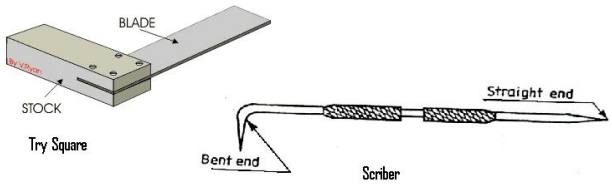
Marking & Measuring Tools

Surface Plate



The surface plate is machined to fine limits and is used for testing the flatness of the work piece. It is also used for marking out small box and is more precious than the marking table. The degree of the finished depends upon whether it is designed for bench work in a fitting shop or for using in an inspection room; the surface plate is made of Cast Iron, hardened Steel or Granite stone. It is specified by length, width, height and grade. Handles are provided on two opposite sides, to carry it while shifting from one place to another.

Try Square

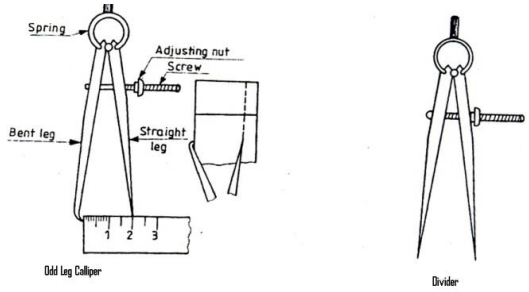


It is measuring and marking tool for 90^0 angle .In practice, it is used for checking the sureness of many types of small works when extreme accuracy is not required .The blade of the Try square is made of hardened steel and the stock of cast Iron or steel. The size of the Try square is specified by the length of the blade.

Scriber

A Scriber is a slender steel tool, used to scribe or mark lines on metal work pieces. It is made of hardened and tempered High Carbon Steel. The Tip of the scriber is generally ground at 12^{o} to 15^{o}. It is generally available in lengths, ranging from 125mm to 250mm .It has two pointed ends the bent end is used or marking lines where the straight end cannot reach.

Odd leg Caliper

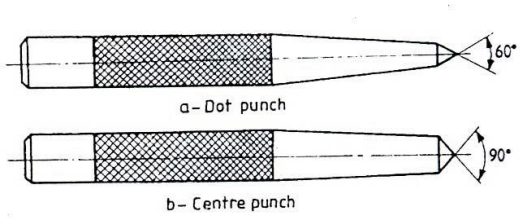


This is also called 'Jenny Caliper' or Hermaphrodite. This is used for marking parallel liners from a finished edge and also for locating the center of round bars; it has one leg pointed like a divider and the other leg bent like a caliper. It is specified by the length of the leg up to the hinge point.

Divider

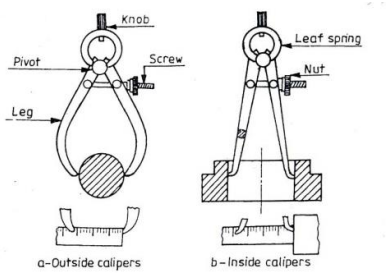
It is basically similar to the calipers except that its legs are kept straight and pointed at the measuring edge. This is used for marking circles, arcs laying out perpendicular lines, by setting lines. It is made of case hardened mild steel or hardened and tempered low carbon steel. Its size is specified by the length of the leg.

Punches



These are used for making indentations on the scribed lines, to make them visible clearly. These are made of high carbon steel. A punch is specified by its length and diameter (say as 150' 12.5mm). It consists of a cylindrical knurled body, which is plain for some length at the top of it. At the other end, it is ground to a point. The tapered point of the punch is hardened over a length of 20 to 30mm. Dot punch is used to lightly indent along the layout lines, to locate center of holes and to provide a small center mark for divider point, etc. for this purpose, the punch is ground to a conical point having 60° included angle. Center punch is similar to the dot punch, except that it is ground to a conical point having 90° included angle. It is used to mark the location of the holes to be drilled.

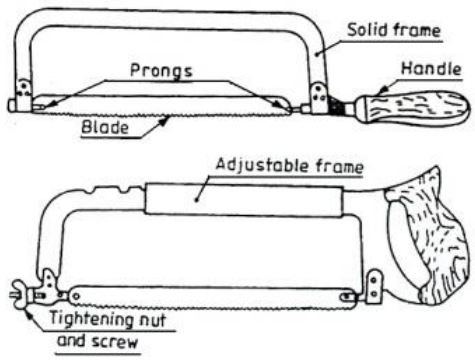
Calipers



They are indirect measuring tools used to measure or transfer linear dimensions. These are used with the help of a steel Rule to check inside and outside measurements. These are made of Case hardened mild steel or hardened and tempered low carbon steel. While using, but the legs of the caliper are set against the surface of the work, whether inside or outside and the distance between the legs is measured with the help of a scale and the same can be transferred to another desired place. These are specified by the length of the leg. In the case of outside caliper, the legs are bent inwards and in the case of inside caliper, the legs bent outwards.

Cutting Tools

1. Hack Saw



Hack Saw

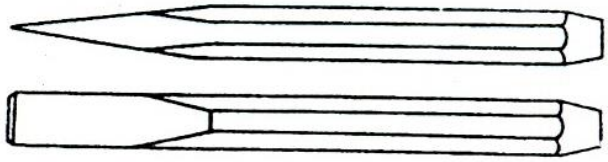
The Hack Saw is used for cutting metal by hand. It consists of a frame, which holds a thin blade, firmly in position. Hacksaw blade is specified by the number of teeth for centimeter. Hacksaw blades have a number of teeth ranging from 5 to 15 per centimeter (cm). Blades having lesser number of teeth per cm are used for cutting soft materials like aluminum, brass and bronze. Blades having larger number of teeth per centimeter are used for cutting hard materials like steel and cast Iron.

Hacksaw blades are classified as (i) All hard and (ii) flexible type. The all hard blades are made of H.S.S, hardened and tempered throughout to retain their cutting edges longer. These are used to cut hard metals. These blades are hard and brittle and can break easily by twisting and forcing them into the work while sawing. Flexible blades are made of H.S.S or low alloy steel but only the teeth are hardened and the rest of the blade is soft and flexible. These are suitable for use by un-skilled or semi-skilled persons.

The teeth of the hacksaw blade are staggered, as shown in figure and known as a ‘set of teeth’. These make slots wider than the blade thickness, preventing the blade from jamming.

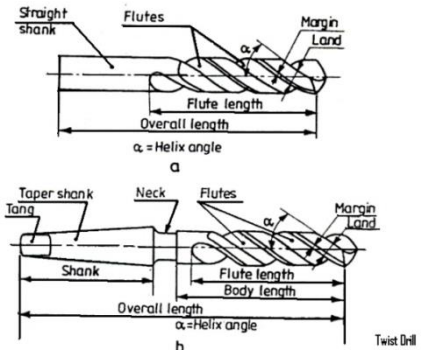
2. Chisels

Chisels are used for removing surplus metal or for cutting thin sheets. These tools are made from 0.9% to 1.0% carbon steel of octagonal or hexagonal section. Chisels are annealed, hardened and tempered to produce a tough shank and hard cutting edge. Annealing relieves the internal stresses in a metal. The cutting angle of the chisel for general purpose is about 60°.



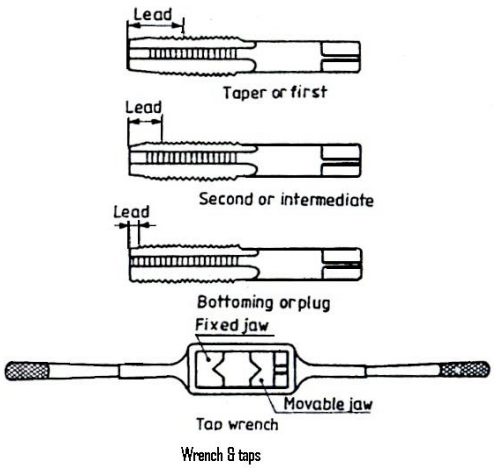
Flat Chisel

3. Twist Drill



Twist drills are used for making holes. These are made of High speed steel. Both straight and taper shank twist drills are used. The parallel shank twist drill can be held in an ordinary self – centering drill check. The tapper shank twist drill fits into a corresponding tapered bore provided in the drilling machine spindle.

4. Taps and Tap Wrenches



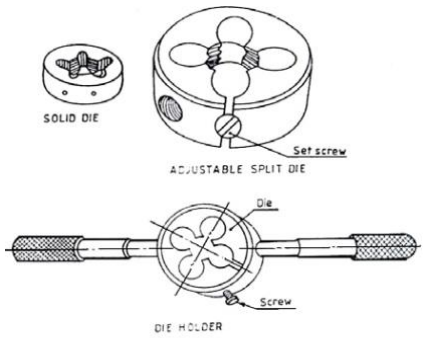
Wrench & taps

A tap is a hardened and steel tool, used for cutting internal thread in a drill hole. Hand Taps are usually supplied in sets of three in each diameter and thread size. Each set consists of a tapper

tap, intermediate tap and plug or bottoming tap. Taps are made of high carbon steel or high speed steel.

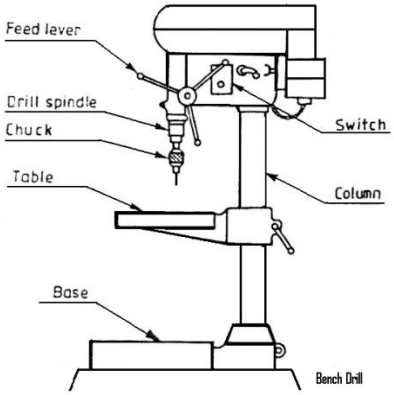
5. Dies and Die Holders

Dies are the cutting tools used for making external thread. Dies are made either solid or split type. They are fixed in a die stock for holding and adjusting the die gap. They are made of Steel or High Carbon Steel.



Die and Die Holder

6. Bench Drilling Machine



Holes are drilled for fastening parts with rivets, bolts or for producing internal thread. Bench drilling machine is the most versatile machine used in a fitting shop for the purpose. Twist drills, made of tool steel or high speed steel are used with the drilling machine for drilling holes.

3.3 Finishing Tools

File Card: It is a metal brush, used for cleaning the files, to free them from filings, clogged in-between the teeth.

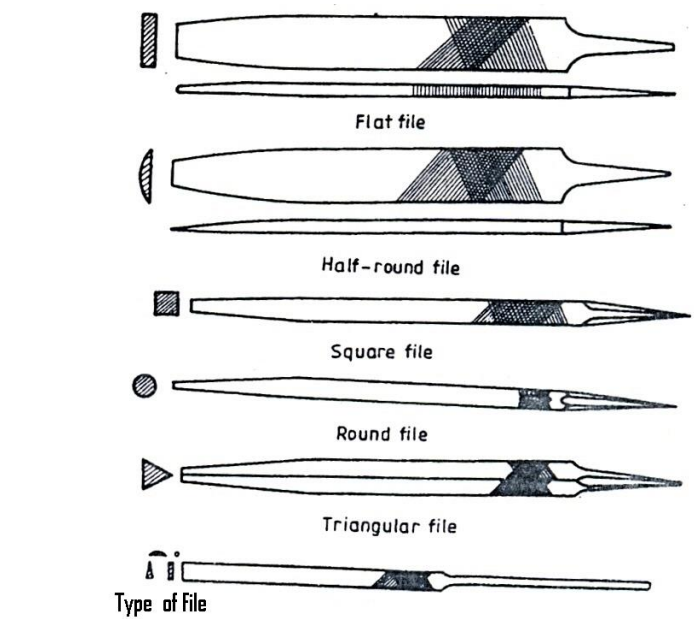
Spirit level: It is used to check the leveling of machines.

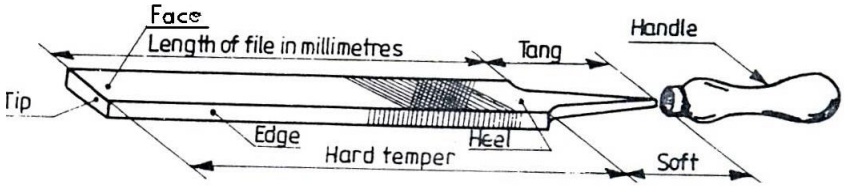
Ball- Peen Hammer: Ball- Peen Hammers are named, depending upon their shape and material and specified by their weight. A ball peen hammer has a flat face which is used for general work and a ball end, particularly used for riveting.

Cross-Peen Hammer: It is similar to ball peen hammer, except the shape of the peen. This is

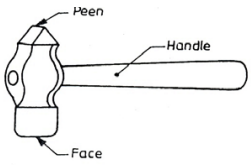
used for chipping, riveting, bending and stretching metals and hammering inside the curves and shoulders.

Straight-Peen Hammer: This is similar to cross peen hammer, but its peen is in-line with the hammer handle. It is used for swaging, riveting in restricted places and stretching metals.

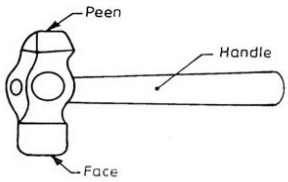




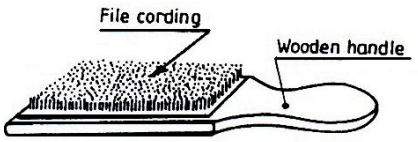
File



Cross Peen Hammer



Straight Peen Hammer



File Card

File: A file is a harden piece of high grade steel with slanting rows of teeth.
Classification of files:

A. According to cut: 1. Single cut 2. Double cut
B. According to grade of cut: 1. Rough 2. Bastard 3.Second cut 4. Smooth 5. Dead smooth 6. Super smooth
C. According to shape: 1. Flat 2. Square 3. Round 4. Half round 5.Triangular 6. Knife edge
D. According to length: Files are of various lengths such as 4”, 6”, 8”, 10” etc.

Way of filling:

Straight filling: The file is pressed forward along the Length of the work. On the back stroke, the file should be lifted from the work piece or pressure should be partly release.

Cross filling: In this type the file movement is approximately at the right angle to the length of job keeping the file in horizontal plane.

Draw filing: here the file is held at right angle to the length of the job. Both the ends of file are pressed equally by both the hands and file is moved to and fro along the length or in the selected part of the length of a job.

SHOP: **EXERCISE NO.:**

FIGURE WITH SCALE:

NOTE:

TOOLS:

CLASS: **ENROLLMENT NO:** **EXERCISE NO:**

Name of material reqd.: Raw material Size:

	Date	Faculty (Sign.)	Store Keeper (Sign.)
Material issued on			
Repeat Material issued on			

WORK DETAILS

Date	Time		Hours	Instructor's Signature	Remarks
	From	To			
Total Hours					

	Date	Instructor (Sign.)	Faculty (Sign.)
Exercise/Job Completed on			
Exercise/Job submitted on			

Quiz:

1. Name different types of hand tools used in fitting shop with description.
2. Write down the function of: a) Surface plate, b) right angle, c) v-block, d) drill e) Vice
3. Draw different types of files& tools used in fitting shop and explain the function of each.

Suggested Reference:

References used by the students:

Rubric wise marks obtained:

Rubrics	1	2	3	4	5	Total
Marks						

Experiment No: 2
To Perform Carpentry Job.

Date:

Competency and Practical Skills:

Relevant CO: CO-1

Objectives: Study of preparation of job & joints, various wood working operations & machines.

Equipment/Instruments:

(1) Marking,, measuring and inspection tools: Accurate marking and measuring is very important to produce components to exact size.
Pencil, try square, marking knife, marking gauge, divider.

(2) Cutting tools: Saws axe and chisel. They are used for fitting, shaping and surface decoration of wooden pieces.

(3) Striking tools: striking is needed for assemble of different parts.
A. Hammers: engineer use ball peen hammer, wood worker use cross-peen and claw hammer. The claw is used for pulling out any nails accidentally bent in driving.
B. Mallets: the mallet is a wooden headed hammer of round or rectangular cross-section the striking face is made flat to the work..

(4) Holding tools: carpenter's bench vice, bar clamp: - to enable a carpenter to perform different operations accurately, the work piece must be held firmly.

(5) Miscellaneous tools: screwdrivers, wood rasp file, etc.

Theory:

Joints in woodworking:

- Lap joint
- Tongue and groove joint
- Mortise and tenon joint
- Dowel joint
- Dovetail joint
- Corner joint: Bridle joint a) tee joint b) corner joint.

Quality of wood:

Wood generally is a fibers materials heaving strength in the direction of fibers but has very low strength across the direction of fibers.

Market norms of timber:

Log: it is the trunk of tree without branches.
Balk: it is the rough squared of wood.
Posted: there are sawed pieces of timber. The dimension of a square varies from 175 to 300 mm and round from 175 to 300 mm in diameter.
Deal: there are parallel sidepieces 225 mm wide and 100 mm think.

Planks: There are parallel sidepiece 50 to 100 mm thick, 250 to 300 mm wide and 3 to 7 meters in length.

Boards or batons: Pieces of wood 25 mm to 50 mm think and 125 to 175 mm wide are known as boards or batons.

Tools and Equipments used in Carpentry Shop:
The tools that are used for carpentry work are as follows:

Marking and Measuring Tool

Carpenter's Rule: Measuring stick consisting of a strip of wood or metal or plastic with a straight edge is used for drawing straight lines and measuring lengths. It are made portable by folding (carpenter's folding rule) or retracting into a coil (metal tape measure) when not in use. When extended for use they are straight. They are in the range of 0 -60 cm.

Straight Rule: A straight rule, or rule, is an instrument used in geometry, technical drawing and engineering/building to measure distances and/or to rule straight lines. The ruler is essentially a straightedge used to rule lines and the calibrated instrument used for determining measurement .

Try Square: A try-square is a woodworking or a metal working tool used for marking and measuring a piece of wood. The square refers to the tool's primary use of measuring the accuracy of a right angle (90 degrees); to try a surface is to check its straightness or correspondence to an adjoining surface. A piece of wood that is rectangular, flat, and has all edges (faces, sides, and ends) 90 degrees is called four square. A board is often milled four squares in preparation for using it in building furniture. it is useful for getting right angles Try-square is sometimes spelled "tri square".

Marking Gauge: A marking gauge is used to mark a line parallel to a straight edge. The stem and stock are made from beech and the thumbscrew from clear yellow plastic. The better quality gauges have brass inserts at the front of the stock. These help reduce the wear on the stock as it is pushed against the surface of the wood - to be marked. The marking gauge is an extremely important tool for marking parallel lines and preparing for cutting joints.

Divider: A divider, also known as a measuring compass, is a mathematical, drafting or cartographic instrument used to aid measurements of the length of irregular lines and of distances on maps or charts. It is commonly used in geometry and in nautical navigation. It is similar in appearance to a drafting compass, the difference being that the drafting compass has a spike on one end and a pencil (or other drawing utensil) on the other which allows the drawing of circles, whereas the dividers has spikes on both ends. Often a compass can be fitted with a spike in place of the drawing utensil and thus converted to dividers.

Cutting Tools

Saws: A saw is a tool that uses a hard blade with an abrasive edge to cut through softer materials. The cutting edge of a saw is either a serrated blade or an abrasive. A saw may be worked by hand, or powered by steam, water, electricity or other power.

Rip Saw: In woodworking, a cut made parallel to the direction of the grain of the work piece is

known as a rip cut. If one were to cut a tree trunk in half from top to bottom, this would be a rip cut — but the term also applies to cutting free lumber. A rip saw is a saw that is specially designed for making rip cuts. The cutting edge of each tooth has a flat front edge and it is not angled forward or backward. It is about 700 mm long with 3 – 5 points or teeth per 25 mm.

Cross Cut Saw: A crosscut saw is a saw that is specially designed for making crosscuts. A crosscut is a cut made horizontally through the trunk of a standing tree, but the term also applies to cutting free lumber. Crosscut saws have teeth that are designed to cut wood at a right angle to the direction of the wood grain. The cutting edge of each tooth is angled back and has a beveled edge. This design allows each tooth to act like a knife edge and slice through the wood, in contrast to a rip saw, which tears along the grain, acting like a miniature chisel. It is about 650 mm long with 8 – 10 points or teeth per 25 mm.

Panel Saw: Panel saw is any type of sawing machine that cuts sheets into sized parts. Panel saws are used by cabinet shops to easily cut plywood and melamine sheets into cabinet components. They are also used by sign shops to cut sheets of aluminum, plastic and wood for their sign blanks. Panel saws typically fall into one of two categories: Horizontal and Vertical. Some higher end panel saws feature computer controls that move the blade and fence systems to preset values. Other lower end machines offer simplicity and ease of use. It is about 500 mm long with 10 – 12 points or teeth per 25 mm.

Tenon or Back Saw: A backsaw is any hand saw which has a stiffening rib on the edge opposite the cutting edge, allowing for better control and more precise cutting than with other types of saws. Backsaws are normally used in woodworking for precise work, such as cutting dovetails, tenons in cabinetry and joinery. Because of the stiffening rib, the backsaws are limited in the depth to which they can cut. Backsaws usually have relatively closely-spaced teeth, often with little or no set. It is about 400 mm long with 12 – 13 points or teeth per 25 mm.

Dovetail Saw: A small backsaw used by furniture makers to cut dovetails and other fine joints. Besides its small size, the distinguishing feature of the dovetail saw that separates it from other backsaws is the thickness of its blade – about 26 gauge. Other backsaws can be about 0.65 mm – 1 mm depending on length and intended purpose. A thin blade and its resulting kerfs allow the most accurate saw cut for a small joint like a drawer's dovetail. It is about 200 mm long with 12 – 13 points or teeth per 25 mm.

Bow Saw: A bow saw is a metal-framed saw in the shape of a bow with a coarse wide blade. This type of saw is also known as a sewed saw or a buck saw. It is a rough tool that can be used for cross-cutting branches (maybe up to 6 inches in diameter) down to size. Traditionally, a bow saw is a woodworking tool used for straight or curved cuts.

Compass Saw: A handsaw with a narrow triangular blade is used for cutting circles and curves in wood. Compass saws have longer, coarser blades than keyhole saws. They are designed for slightly heavier work such as cutting holes in subflooring for plumbing or electrical wiring.

Chisels: A chisel is a tool with a characteristically shaped cutting edge (such that wood chisels have lent part of their name to a particular grind) of blade on its end, for carving or cutting a hard material such as wood, stone, or metal. The handle and blade of some types of chisel are made of metal or wood with a sharp edge in it. In use, the chisel is forced into the material to cut the material. The driving force may be manually applied or applied using a mallet or hammer. In industrial use, a hydraulic ram or falling weight ('trip hammer') drives the chisel into the material

to be cut.

Firmer Chisel: The firmer chisel is used to remove fairly large pieces of waste and because the blade is thicker it can withstand rough treatment, but not hitting with a mallet. The paring chisel is used for taking off small quantities of wood in thin slices. The blade is thinner and will not stand knocking about. The mortise chisel is used for chopping mortises (rectangular holes) and is robust with a shock absorbing washer to enable it to be struck with a mallet. It has blade about 125 mm long and the width varies from 1.5 to 50 mm.

Bevel Chisel: A chisel is used for cutting wood, having its cutting edge at an angle to the sides. They are slightly undercut making them easy to push into corners. They are normally used for finishing dovetail joints.

Mortise Chisel: Mortise chisels are used for 'chopping out' joints (chiseling away the waste wood). They are particularly useful for cutting mortise joints as they are strong enough to withstand heavy blows with a mallet. Blade width varies from 3 – 16 mm.

Planning Tools

Jack Plane: A jack plane is the general-purpose bench plane, used for general smoothing of the edges, sizing of wood and jointing edges. Jack planes are about 400 mm long and the blade can have either a slightly curved edge for smoothing stock, or a straight edge for jointing stock.

Trying Plane: Trying plane is a type of hand plane used primarily to straighten the edges of boards in the operation known as jointing. A jointer plane may also be used to flatten the face of a board. Its long length is designed to 'ride over' the undulations of an uneven surface, skimming off the peaks, gradually creating a flat surface. In thickness or preparing rough stock, the jointer plane is usually preceded by the jack plane and followed by the smoothing plane. These are typically 510 to 610 mm long.

Smoothing Plane: A smoothing plane or smooth plane is a type of bench plane used in woodworking. The smoothing plane is typically the last plane used on a wood surface - when used properly; the finish it gives will be far superior to that made by sandpaper or scrapers. The smooth finish is the result of planning the wood off in strips, rather than by successive buffing and scratching. The smoothing plane is typically 8 to 10 inches long.

Rebate Plane: The rebate plane (also known as the rabbet plane) is a hand plane designed for cutting rebates in wood. The rebate plane is one of a group of planes including the shoulder plane, bull nose plane and carriage makers plane in which the blade protrudes by a very small amount - usually less than half a millimeter - from the sides of the plane body on both sides. The blade is very slightly wider than the body of the plane. The reason for the slight protrusion of the blade is so that the plane body does not bind on the side of the cut, which would result in the side wall of the rebate not being perpendicular to the bottom. Rebate planes are intended for long grain cutting and are generally setup to remove large amounts of material quickly.

Metal Plane: The metal plane serves the same purpose but facilitate a smoother operation. The body of the metal plane is made of a grey iron casting. The thickness of the shaving blade removed is governed by a fine screw adjustment and a lever is used for adjusting the blade at right angle.

Boring Tools

Boring tools are used to make round holes in wood and they are selected according to the type and the purpose of the hole. They include bradawl, gimlet, brace and drill bit.

Bradawl: A bradawl is a tool with a blade similar to that of a straight screwdriver and a handle made from wood or plastic. A bradawl is used to make an indentation in wood or other materials in order to ease the insertion of a nail or screw. The blade is placed across the fibers of the wood, cutting them when pressure is applied - the bradawl is then twisted through 90 degrees which displaces the fibers creating a hole. This cutting action helps to prevent splitting of the wood along the grain.

Gimlet: A gimlet is a hand tool for drilling small holes, mainly in wood, without splitting. A gimlet is always a small tool. The cutting action of the gimlet is slightly different; the cutting edges pare away the wood which is moved out by the spiral sides, falling out through the entry hole. This also pulls the gimlet further into the hole as it is turned; unlike a bradawl, pressure is not required once the tip has been drawn in.

Drill Bit: Drill bits are cutting tools used to create cylindrical holes. Bits are held in a tool called a drill, which rotates them and provides torque and axial force to create the hole. Specialized bits are also available for non-cylindrical-shaped holes.

Striking Tools

Hammers: A hammer is a tool meant to deliver an impact to an object. The most common uses are for driving nails, fitting parts, forging metal and breaking up objects. Hammers are often designed for a specific purpose, and vary widely in their shape and structure. The usual features are a handle and a head, with most of the weight in the head. The basic design is hand-operated, but there are also many mechanically operated models for heavier uses.

Mallets: A mallet is a kind of hammer, usually of wood, smaller than a maul or beetle and usually with a relatively large head. Wooden mallet, usually used in carpentry to knock wooden pieces together or to drive dowels or chisels. A wooden mallet will not deform the striking end of a metal tool, as most metal hammers would, but it also reduces the force available to drive the cutting edge of a chisel. Hardwood mallet is also used to knock in a cricket bat. Rubber mallets are used when a softer blow is called for than that delivered by a metal hammer. They are typically used to form sheet metal, since they don't leave marks, as well as for forcing tight-fitting parts together, for shifting plasterboard into place, in upholstery, and a variety of other general purposes, including some toys. It is the most commonly used mallet.

Holding Tool

Bench Vice: A vise or vice (see American and British English spelling differences) is a mechanical screw apparatus used for holding or clamping a work piece to allow work to be performed on it with tools such as saws, planes, drills, mills, screwdrivers, sandpaper, etc. Vises usually have one fixed jaw and another, parallel, jaw which is moved towards or away from the fixed jaw by the screw.

Bench Stop: Bench stop is simply a block of wood projecting above the top surface of the bench. This is used to prevent the wood from moving forward when being planned. The other types of holding devices used are bench holdfast, sash clamp, G cramp, hand screw etc.

Carpentry Joints: There are many kinds of joints used to connect wood stock. Each joint has a definite use and requires lay in-out, cutting them together. The strength of the joint depends upon amount of contact area. If a particular joint does not have much contact area, then it must be reinforced with nails, screws or dowels.

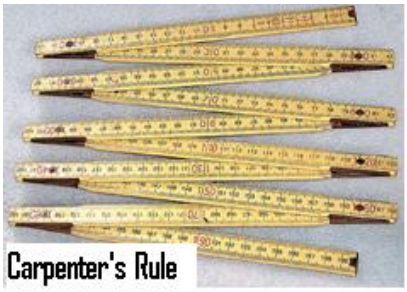
Lap Joint: In lap joints, an equal amount of wood is removed from each piece, as shown in figure. Lap joints are easy to layout, using a try-square and a marking gauge. Follow the procedure suggested form sawing and removing the waste stock. If the joint is found to be too tight, it is better to reduce the width of the mating piece, instead of trimming the shoulder of the joint. This type of joint is used for small boxes to large pieces of furniture.

Mortise and Tenon Joints

It is used in the construction of quality furniture. It results in a strong joint and requires considerable skill to make it. The following are the stages involved in the work.

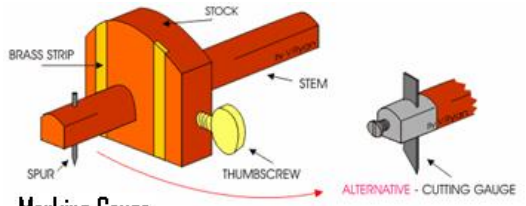
- Mark the mortise and tenon layouts.
- Cut the mortise first by drilling series of holes within the layout line, chiseling out the waste stock and trimming the corners and sides.
- Prepare the tenon by cutting and chiseling.
- Check the tenon size against the mortise that has been prepared and adjust it if necessary.

Bridle Joint: This is the reverse of mortise and tenon joint in form. The marking-out of joint is the same as for mortise and tenon joint. This joint is used where the members are of square or near square section and unsuitable for mortise and tenon joint.

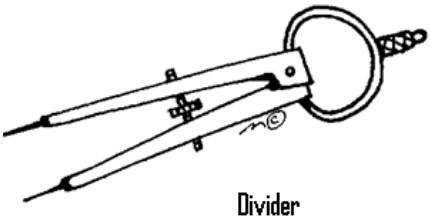

Carpenter's Rule


Straight Rule

Try Square



Marking Gauge


Divider

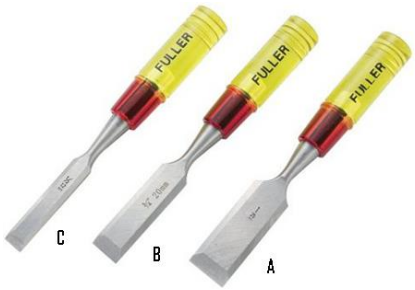

Rip Saw

Panel Saw

Dovetail Saw

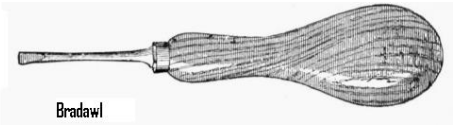
Bow Saw

Compass Saw



A - Fiemer Chisel / B - Bevel Chisel / C - Mortise Chisel

Metal Plane

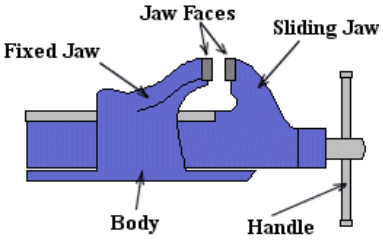


Bradawl

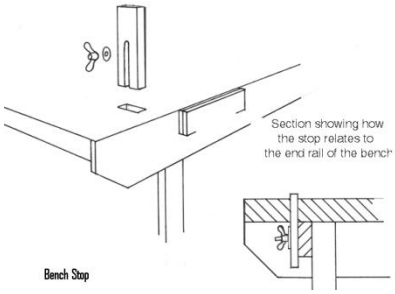
Gimlet

Drill Bit

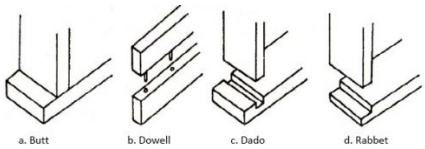
Mallet

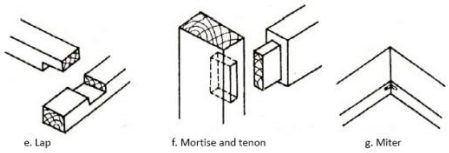


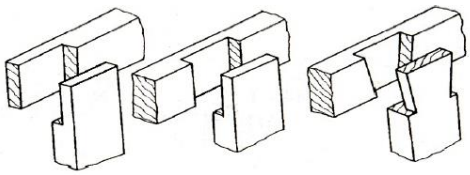
Bench Vice



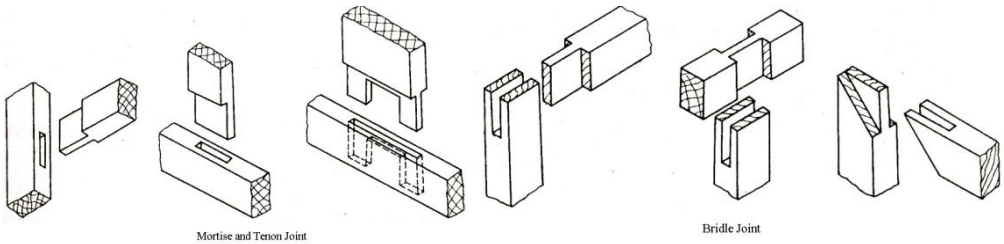
Bench Stop







Lap joints



Mortise and Tenon Joint

Bridle Joint

Wood working machines: Wood turning machine**,** Planer**,** Band saw**,** Circular saw**,** Radial saw, Mortising machine**,** Sanding machine**,** Portable machine, etc.

SHOP: **EXERCISE NO.:**

FIGRE WITH SCALE:

NOTE:

TOOLS:

CLASS: **ENROLLMENT NO:** **EXERCISE NO:**

Name of material reqd.: Raw material Size:

	Date	Faculty (Sign.)	Store Keeper (Sign.)
Material issued on			
Repeat Material issued on			

WORK DETAILS

Date	Time		Hours	Instructor's Signature	Remarks
	From	To			
Total Hours					

	Date	Instructor (Sign.)	Faculty (Sign.)
Exercise/Job Completed on			
Exercise/Job submitted on			

Quiz:

1. State different marking tools & measuring tools used in carpentry shop.

2. Write down with sketch different types of cutting tools used in carpentry shop?

Suggested Reference:

References used by the students:

Rubric wise marks obtained:

Rubrics	1	2	3	4	5	Total
Marks						

Experiment No: 3
To study different Types of sheet metal joints.

Date:

Competency and Practical Skills:

Relevant CO: CO-1

Objectives: To study different Types of joints by Sheet metal.

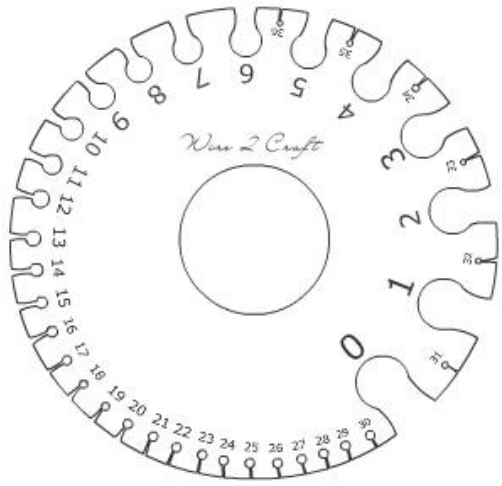
Equipment/Instruments: Hand shearing machine, Hammer, Mallet, Snip, Standard wire gauge, Trammel.

Theory:

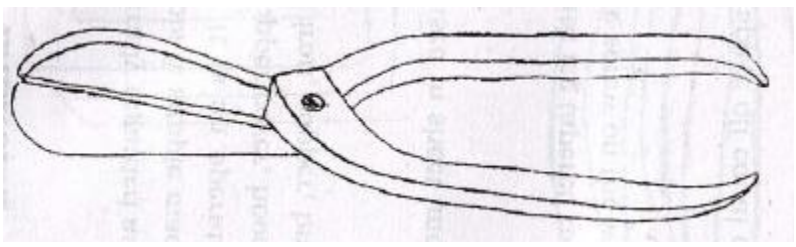
Sheet metal deals with making of metal boxes, cans, funnels, and ducts from flat sheet metal. In this, the development is drawn on the sheet metal and cut and folded to form the required shape of the object. For successful working in the trade. One should have through knowledge of projective geometry. Particularly of the development of surfaces.

Sheet metal can be classified as
1. Tin
2. Sheet
3. Plate

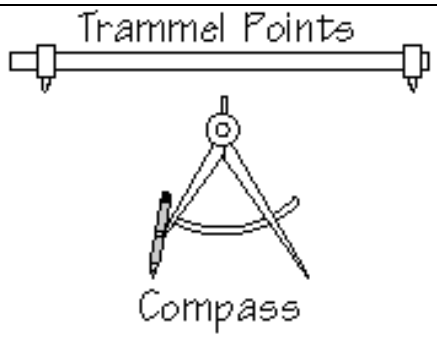
Tin having thickness of 0.5mm to 2.0mm
Sheet having thickness of 2.0mm to 4.0mm
Plate having thickness of more than 4.0mm



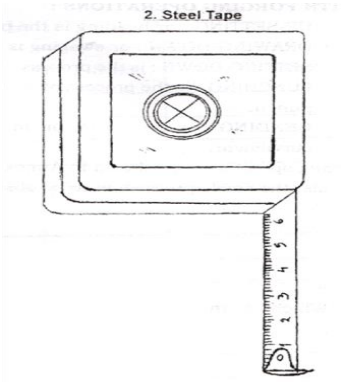
Wire Gauge



Snip straight



Trammel



Steel Tape

Machine used in sheet metal shop:

Shearing machine:
This is a universal shearing machine & is must in any sheet metal shop. It can perform number of operations. For e.g. sheet cutting, flat shearing, round bar shearing, square bar shearing, angle cutting etc. These machines are specified by their cutting capacity (by thickness & width of sheet)

Bending machine:
There are two types of bending machine for sheet metal work. One is roller-bending machine, which is used for bending the flat sheet in cylindrical shape. The other one is Press bending machine, which is used to bend the flat sheet a appropriate angle as per the punch & die set.

Sheet Metal Assembly

Joining of sheet metal components are generally achieved by soldering, Brazing, Gas welding, spot welding & Riveting. Out of these, Riveting is more frequently used.

Rivets: a rivet is a short cylindrical bar with a head integrated to it. The rivets are used to fasten sheets & plates.

There are different types of rivets:

(1) Round head (2) Pan Head (3) Flat head (4) Countersunk

Forming rivets head:
In sheet metal shop the rivet head is formed with the help of a riveting set. The deep hole is used to draw the sheets & rivet together, by striking the rivet set with a hammer. The drop hole should be slightly larger than the diameter of the rivet to facilitate smooth operation. Then the rivet is flattened down with hammer blows direct on the rivet shank end. Finally, head is formed in the cup shaped hole of rivet set by striking the set with a hammer.

Measuring Tools

1. **Steel Rule**
   A ruler, or rule, is an instrument used in geometry, technical drawing and engineering/building to measure distances and/or to rule straight lines.
2. **Folding Rule**
   Measuring stick consisting of a strip of wood or metal or plastic with a straight edge is used for drawing straight lines and measuring lengths. It are made portable by folding (carpenter's folding rule) or retracting into a coil (metal tape measure) when not in use. When extended for use they are straight.
3. **Vernier Caliper**
   These are used for measuring outside as well as inside dimensions accurately. It may also be used as a depth gauge. It has two jaws. One jaw is formed at one end of its main scale and the other jaw is made part of a Vernier scale.
4. **Micrometer**
   A micrometer, also known as a micrometer screw gauge, is a device used widely in mechanical engineering and machining as well as most mechanical trades for precision measurement, along with other metrological instruments such as dial calipers and

Vernier calipers.

5. **Sheet Metal Gauge**
   It is the tool used to measure the thickness of the sheet. It gives the thickness in both mm and gauge.

6. **Marking Tools**

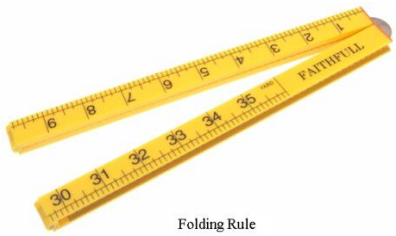
   1. **Try Square:** Try square is used for making and testing angles of 90^{o}.
   2. **Scriber:** It used to scribe or mark lines on metal work pieces.
   3. **Divider:** This is used for marking circles, arcs, laying out perpendicular lines, bisecting lines, etc.

7. **Cutting Tool**

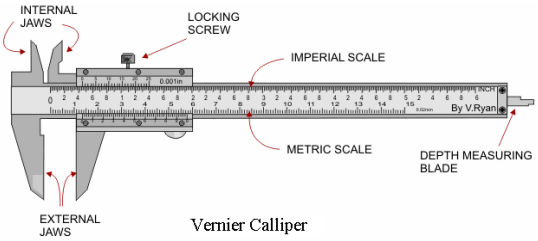
   1. **Straight Snip**
      They have straight jaws and used for straight line cutting.
   2. **Curved Snip**
      They have curved blades for making circular cuts.

8. **Striking Tool**
   1. **Hammer**
      A hammer is a tool meant to deliver an impact to an object. The most common uses are for driving nails, fitting parts, forging metal and breaking up objects. Hammers are often designed for a specific purpose, and vary widely in their shape and structure. The usual features are a handle and a head, with most of the weight in the head. The basic design is hand-operated, but there are also many mechanically operated models for heavier uses.
   2. **Mallet**
      It is wooden-headed hammer of round or rectangular cross section. The striking face is made flat to the work. A mallet is used to give light blows to the Sheet metal in bending and finishing.

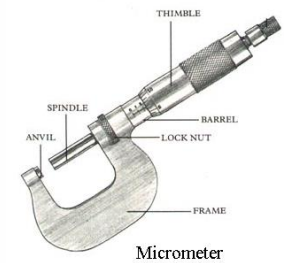

Steel Rule



Folding Rule

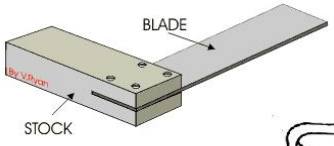


Vernier Calliper

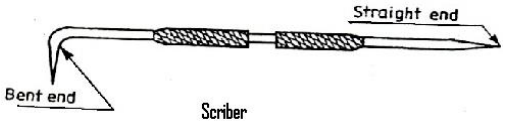


Micrometer

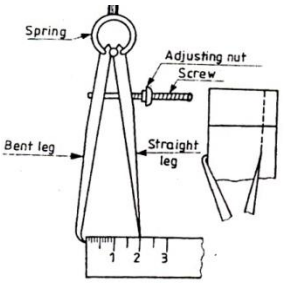

Sheet Metal Gauge



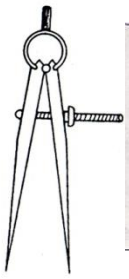
Try Square



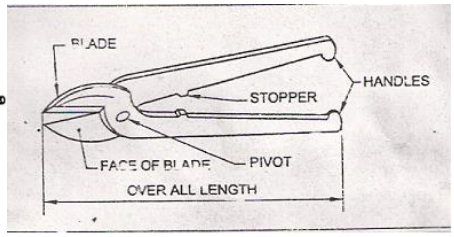
Scriber



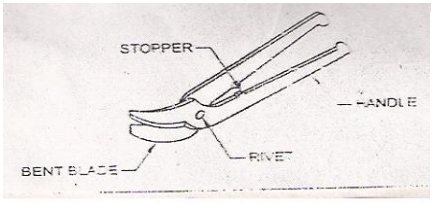
Odd Leg Calliper



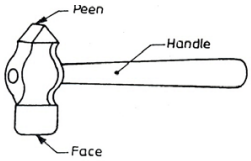
Divider



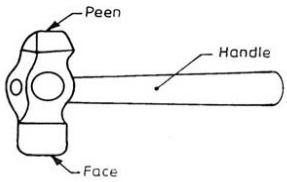
Straight Snip



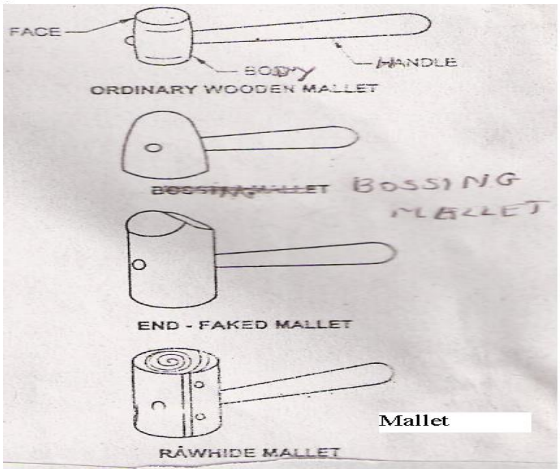
Curved Snip



Cross Peen Hammer



Straight Peen Hammer



Mallet

SHOP: **EXERCISE NO.:**

FIGURE WITH SCALE:

NOTE:

TOOLS:

CLASS: **ENROLLMENT NO:** **EXERCISE NO:**

Name of material reqd.: Raw material Size:

	Date	Faculty (Sign.)	Store Keeper (Sign.)
Material issued on			
Repeat Material issued on			

WORK DETAILS

Date	Time		Hours	Instructor's Signature	Remarks
	From	To			
Total Hours					

	Date	Instructor (Sign.)	Faculty (Sign.)
Exercise/Job Completed on			
Exercise/Job submitted on			

Quiz:

1. Write down with sketch different types tools used in sheet metal shop?
2. Write down the procedure for making job with sheet metal shop.

Suggested Reference:

References used by the students:

Rubric wise marks obtained:

Rubrics	**1**	**2**	**3**	**4**	**5**	**Total**
Marks						

Experiment No: 4
To study plumbing hand tools & fitting.

Date:

Competency and Practical Skills:

Relevant CO: CO-2

Objectives: To know the different type of fittings and Plumbing tools.

Equipment/Instruments: Pipe wrench, Plumbing vice, threading set (Die Set), Hack saw

Theory:

Plumber is an artisan (workman) who fits & repairs pipes, cisterns (systems) etc. by using lead, copper, tin etc. the word plumber is derived from Latin word "plum bum" meaning lead. Hence plumber is a workman is working with lead.
Plumbing is associated with we planned & paved drains & water supply system for individual house including bathrooms, toilets, kitchen, garden etc. in includes good water carriage or water handing system, drainage system for societies & cites, sewage & waste water plans, rain water plants, sanitation plants, hazardous gas pipelines, effluent treatment plants etc. original lead sheets were rolled to make pipes & then used for drainage systems. Then copper & iron pipes were introduced in urban or remote areas leaching pits or kharkuva'a are prepared. The waste water along with human excreta & kitchen drain are passed through setting pits & septic pits & then allowed inside leaching pits where the water gets absorbed in to side hollow earthen wall areas.
After this underground drainage system was developed where all domestic waste semi liquids, industrial wastewater, rain water were treated chemically before discharge.
All plumping is an integral part with pipelines for water, steam, fuel oil, chemicals, gas, pneumatic airlines, refrigerators etc.

PLUMBING FIXTURES
They are commonly known & used are water closets (WC) wash basins, sinks, bath tubs, taps, cocks, valves, gull trap, fitters, strainers etc. the basic requirement of above material is non – absorbent, smooth material, free from dents or cavities, located in well-lighted & ventilated areas. It should be non-corroding to avoid blockage or back flow or leakages.

PLUMBING MATERIALS
CERAMIC- fixtures are manufactured by moulding diff. Types of china clay to the required shape & size. Then spray of glazing material is done on these items. After this it is taken in to mobile racks which slowly pass through the kiln where high temp firing is done continuously for specified time holding. This result in to high strength, non-absorbity, and glossy finishes neat & clean non-porous surface & good for sanitation purpose.

Cast iron – used for bath tube, washbasin sinks to certain places. Casting is done to required shape & size, then vitreous enameling done in to & then taken to high temp kiln to make to hard surface, scratch free surface & corrosion resistant surface.

Pressed steel- mild steel or stainless steel sheets are pressed on hydraulic presses with suitable die & punch & then if required vitreous enameled. Stainless steel components are light in weight, corrosion resistant, sturdy and are used in kitchen, railway, toilets, laboratories etc.

FRP - it is known as fiberglass-reinforced plastic, which is cold, molded from synthetic resins & reinforced with mats strands of fiberglass. It is used for bathtubs, shower trays, and washbasins, swimming pools dividing boards, water slider etc.

Acrylic-it is a thermal plastic that can be molded heated hydraulic pressed to any shape & size. It is harder, smoother & more scratch resistant in comparison to FRP. It is used for bath tubes, washbasin and sinks etc.

Poly marble – OR synthetic marble-_it is mix cold moulding suitable china clay & resin to give hard & smooth surface.

Brass & gun metal-_tape, fitting, steam traps, valves etc. are mode from gun metal due to corrosion free criteria where casting body is used, the contact liquid parts are made from brass, gun metal or copper.
Plastic-_very good for corrosion resistant & good for rough handing. It is good for high-pressure application also.

Other standard materials also used for plumbing & piping are galvanized iron, wrought iron, al, glass, rubber, cement concrete hard & flexible PVC. etc.

CLASSIFICATION & TYPES OF PIPE FITTING USED IN PLUMBING

(1) Standard 20 ft or 6.0 m long pipes with two thread ends. Sizes available are 15 mm, 20 mm, 25 mm, 30 mm, 35 mm, 50 mm, 65 mm, 75 mm, 90 mm, 100 mm, 125 mm, 150 mm, 200 mm up to 400 mm.

Classes in pipes-

A class – 3.15 mm thickness – low pressure
B class – 4.50 mm thickness – med pressure
C class – 6.25 mm thickness – high pressure

Types-

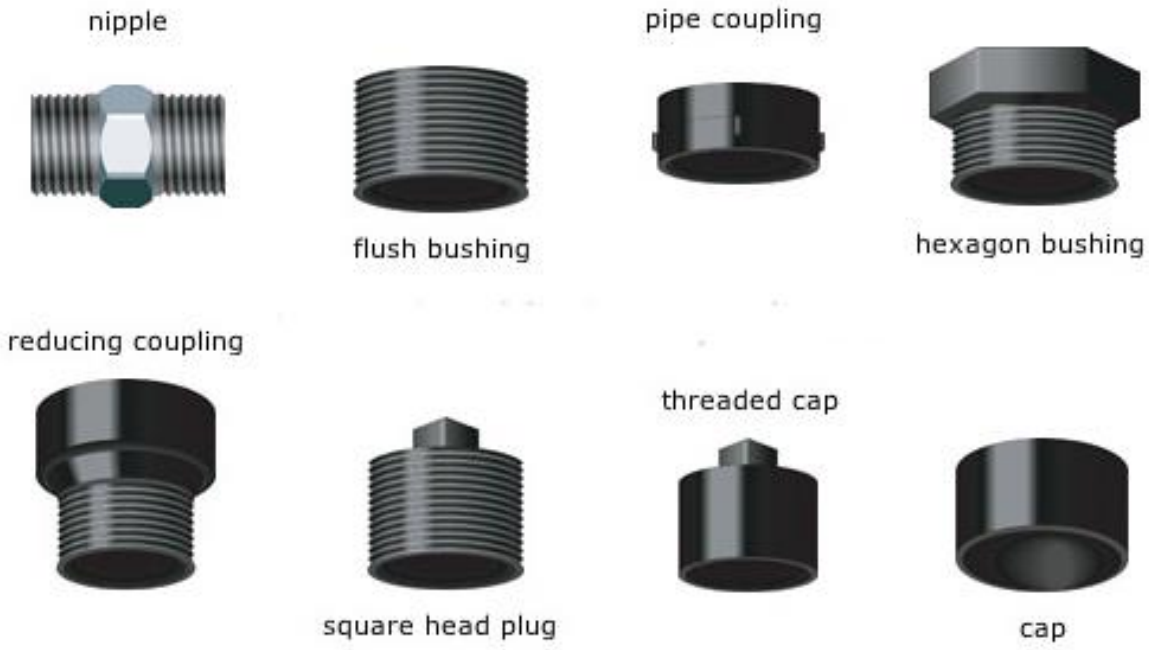
ERW – Electric resistance welded
S L- seams less – without weld joints

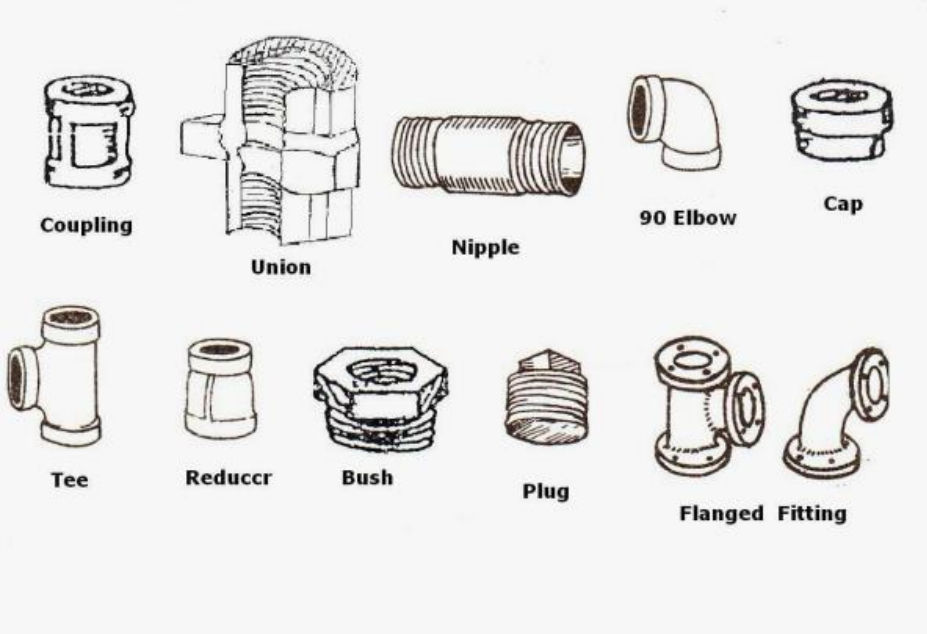
(2) Coupling – having internal thread.
(3) Elbow - 90°elbow to divert pipe line & have internal threads.
(4) Bend - 90°for smooth flow.

They are either long radius or short radius.
They are, either both ends threaded outside, or one end threaded.

They are also butt weld type, means without threads.
They are also ERW type or seamless type.

(5) Tee – it is having one branch in center at 90 & have internal threads.
(6) Cross – it is having internal threads in all four directions at 0°, 90°, 180°, and 270° & makes cross connections easy.
(7) Reducer / increaser – when size or pipes requires to either decrease or increase then reducer or enlarger couplings having internal threads are used for subsequent sizes.
(8) Pipe nipple straight – it it's a cut pipe of pipe having standard length & external thread either on one side or both sides for easy assemble of control valve length adjustments.
(9) Hexagonal nipple – it is a nipple with both side's external threads & in center hexagonal face is kept for tightening purposes.
(10) Cap or plug – when one end of the pipes needs to block the flow of liquid, the cap or blind plug is fitted with the help of coupling.
(11) Union – when the pipelines commence from two different directions & are to be aligned & fixed then union is used. It is a two part assemble having internal threads suitable for pipe & other for matching part.
(12) C I- cast iron pipes & pipe fitting – double Y junction plane, T junction plane, single Y junction plane, 90° bend or elbow are available for large size plumbing.
(13) UPVC pipe – it is plasticized poly vinyl chloride (upvc) or rigid PVC pipes. Here the plastic resins are extruded in special machines under close temp. Control & manufacturing processes. It is suitable for temp. Up to 60°C all the fitting like coupling, sockets spigots are available. They are joined with solvent cement & "o" ring & rubber joint help in leak proof joints.
(14) HDPE pipes – ABC pipes, Teflon pipes, FRP pipes, are also the latest materials used.
The inside diameter of pipes is made lager than specified to compensate for loss of flowing liquid in pressure & friction losses with pipe walls. 12mm, id pipe will have 15mm & 25mm pipe will measure 28mm.





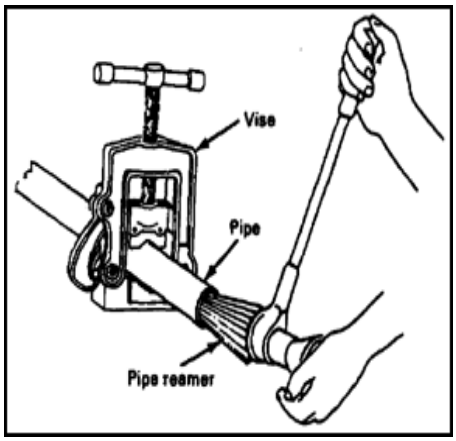
PLUMBING TOOLS

The standard plumbing tools used are –

1. Pipe wrenches- used for fitting or opening.
2. Workbench – used o / for small component fitting.
3. Pipes vice – used for holding & clamping the pipe for manual threading.
4. Threading dies & taps – diff size are used to do threading manually by adjusting the depth of cut of threads.
5. Pipe bending equipment – some time fix & guide pulleys are used or hydraulic pipe bending until is used to bend pipe at suitable inner radius after filling sand inside the pipe.
6. Hacksaws – handsaw is used to cut the pipe to required length.
7. Pliers – is used for fixing "O"rings union.
8. Jute hemp & safe do – it is used to seal the threaded joints by applying on threads.
9. Teflon tape reel – it is also used to seal the joints where thread are perfect matching with close tolerances.
10. Water supply – basic requirements are for domestic use, A. C & Ventilation or cooling towers, swimming pools, fir fighters, Gardening, residence, factories, hospitals, hotels, offices, Restaurants, theaters, school & colleges, railway & transportation, Services, airports etc.

Pipeline should be with such slope that no air locks are there. Isolation valves are to be fixed as appropriate distances. Make up line should be providing along with check valves & drain valves. High temp, high pressure, hot liquid line should be provided with proper thickness of insulation. The normal insulation materials are mineral wool, glass wool, polyurethane, thermo Cole etc. & packed with steel wires & jute cloth & then colored black or white.

Die Set



Pipe Vise

Tap Set

CORROSION

Different types of corrosions are there. They are galvanic, electrolytic, stress corrosion bio chemical etc & needs to be reduced in intensity or removed or action is required to stop or minimize the rate of corrosion.

SHOP: **EXERCISE NO.:**

FIGURE WITH SCALE:

NOTE:

TOOLS:

CLASS: **ENROLLMENT NO:** **EXERCISE NO:**

Name of material reqd.: Raw material Size:

	Date	Faculty (Sign.)	Store Keeper (Sign.)
Material issued on			
Repeat Material issued on			

WORK DETAILS

Date	Time		Hours	Instructor's Signature	Remarks
	From	To			
Total Hours					

	Date	Instructor (Sign.)	Faculty (Sign.)
Exercise/Job Completed on			
Exercise/Job submitted on			

Quiz:

1. What is the difference between elbow & bend?
2. What is the difference between nipple, coupling & union? Compare all with sketch.
3. What is the difference between cap and plug?

Suggested Reference:

References used by the students:

Rubric wise marks obtained:

Rubrics	1	2	3	4	5	Total
Marks						

Experiment No: 5
To study various types of welding processes

Date:

Competency and Practical Skills:

Relevant CO: CO-2

Objectives: To know the different type of welding processes.

Theory:

Welding is a process of joining similar metal by application of heat with or without application of process and addition of filler material. The result is a continuity of homogeneous material of the composition and characteristics of two parts, which are being joined together. The application of welding are so varied and extensive that it would be no exaggeration to say that there is no metal industry and there is no any branch of engineering that does not make use of welding in one from or another. In fact, the father of any new metal may depend on how far it would lend itself to fabrication by welding.

Weld ability:-

The term "Weld ability" has been defined as the capacity of being welded into inseparable joints having specified properties such as definite weld strength, proper structure, etc. this means, of course, that if a particular metal is to have good weldability, it must be welded readily so as to perform satisfactorily in the fabricated structure. However, the real criterion in deciding on the weldability of metal is the weld quality and the ease with which it can be obtained.

Weldability depends on one or more of five major factors:

- Melting Point
- Thermal conductivity,
- Thermal expansion,
- Surface condition,
- Change in microstructure.

If these metallurgical, chemical, physical and thermal characteristics of a metal are considered undesirable with respect to weldability, they may be corrected by proper shielding atmosphere, proper fluxing material, proper filler metal, proper welding procedure, and some cases by proper heat treatment of the metal before and after deposition.

Types of Welding:-

Modern methods of welding may be classified under two broad heading:

- **Plastic welding and Fusion welding**

They are also called pressure welding, and non-pressure welding, respectively.

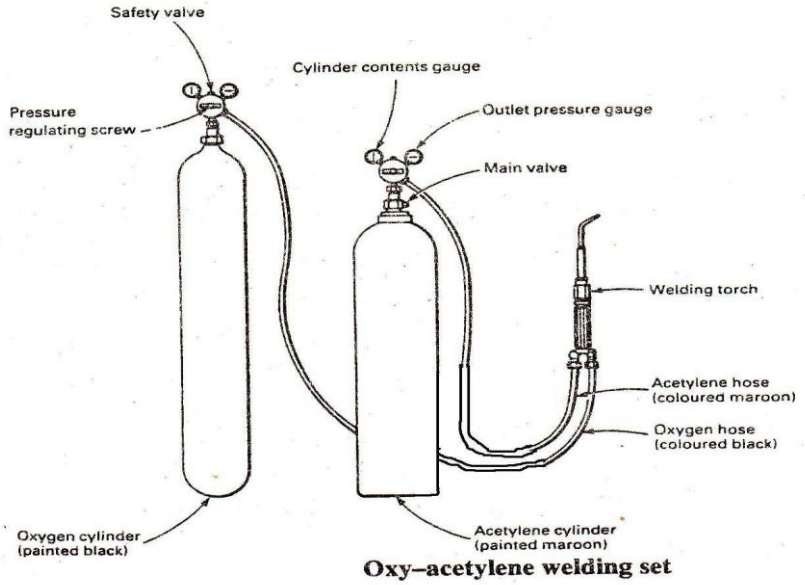
In the plastic welding or pressure welding, the pieces of metal to be joined are heated to a plastic state and then forced together by external pressure. This procures is used in forge welding, resistance welding, “thermit” welding and gas welding. In which pressure is required.

In the “fusion welding” the material at the joint is heated to a molten state and allowed to solidity. This includes gas welding arc welding “thermit” welding etc.

In is seen, that except in cold-welding heat is used to bring about a plastic or molten state at the surface of the metal to be joined. In cold welding, the joints are produced without the application of heat, but by applying pressure which result in inter surface molecular fusion of the parts to be joined. This process is mainly used for welding nonferrous sheet metal particularly aluminum and its alloys.

Gas Welding:

Burning a combustible gas with air or oxygen in a concentrated flam of high temperature does



Oxy–acetylene welding set

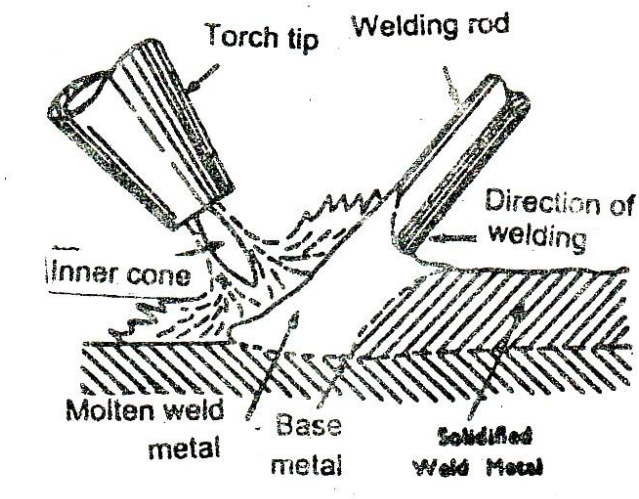
AIR–ACETYLENE WELDING

welding. As with other welding methods, the purpose of the flame is to heat and melt the parent metal and filler road of a joint. It can weld most common materials. Equipment is inexpensive; versatile, and serves adequately in many job and general repair shops.

Oxy-Acetylene Welding:

Melting the edges or surface to be joined by gas flame and allowing the molten metal to flow together accomplish oxy-acetylene gas welding, thus forming a solid continuous joint upon cooling. This process is particularly suitable for joining metal sheets and plates having thickness of 2 to 50 mm. within the form of welding rod. The composition of the filler rod is usually the same or nearly the same as that of the part being welded. To remove the impurities and oxides present on the surfaces of meta to be except mild steel, which has more manganese and silicon that act as deoxidizing agents.

Various gas combinations can be used for producing a hot flame for welding metals. Common mixture of gases is oxygen and acetylene, oxygen and hydrogen, oxygen and other fuel gas, and air and acetylene. The oxygen-acetylene mixture is used to a much greater extend then the other and has a prominent place in the welding industry. The temperature of the oxy-acetylene flame is in its hottest region is about 3200^0C.

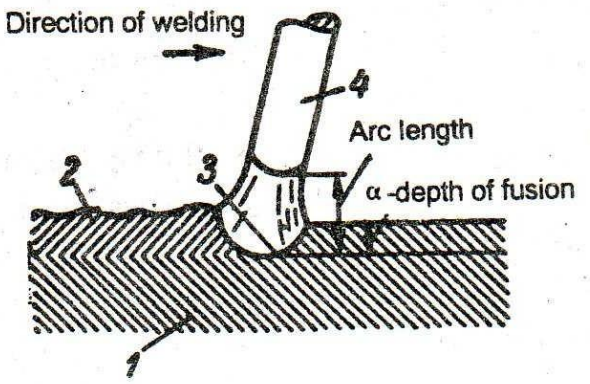


Oxy-acetylene Welding

Gas flame:

The correct adjustment of the flame is important for reliable works. When oxygen and acetylene are supplied to torch in equal volumes, a natural flame is produced having a maximum temperature of 3200^0C. This neutral flame is desired for most welding operations, but in certain cases a slightly oxidizing flame, in which there is an excess of oxygen or slightly carburizing flame, in which there is an excess of acetylene is needed.

Arc Welding Methods:

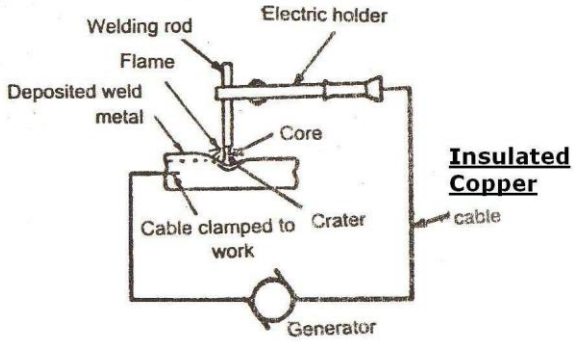


A welding arc
1. parent metal, 2. deposited metal,
3. crater, 4. electrode

The main types of arc welding are:

- Carbon-arc welding
- Metal arc welding
- Metal-inert-gas-arc (MIG) welding
- Gas-tungsten-arc (TIG) welding
- Atomic hydrogen arc welding
- Plasma-arc welding
- Submerged-arc welding
- Flux-cored arc welding]
- Electro-slag welding

Metal-arc Welding:



Metal-arc Welding Circuit

In the metal-arc welding a metal rod is used as one electrode, while the work being welded is used as another electrode. The temperature produced is about 24300 and 2600^0C on the

negative and positive electrode respectively. During the welding operation, this metal electrode is melted by the heat of the arc, and is fused with the base metal, thus forming a solid union after the metal has been cooled. Both ac and dc current may be used. A metal-arc welding circuit is illustrated in Figure. Adjusting the machine to the correct amperage, which is determined by the size of the rod to be used, starts the welding operation. The correct welding speed is important. Various currents can have a deciding effect on the forming of proper heads. A welding shows bead characteristics under different conditions:

(1) Welding current too low – excessive pilling of the metal.

(2) Welding current too high – causing excessive splatter.

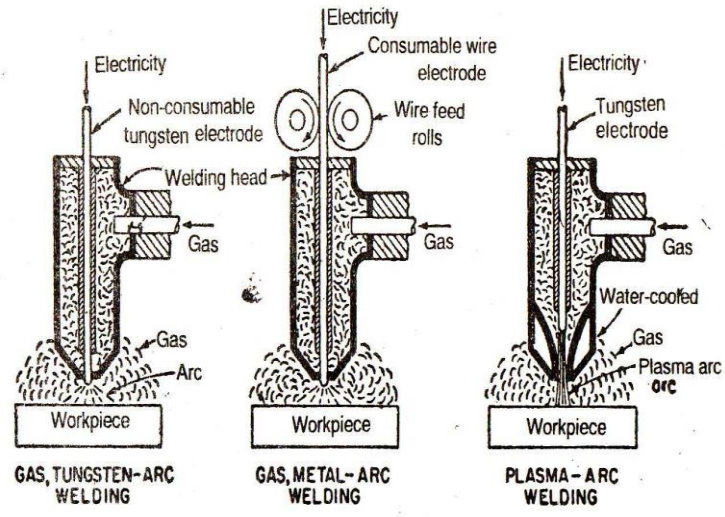
(3) Voltage too high - bead too small.

(4) Welding speed too slow - cause excessive pilling up or weld metal.

(5) Proper current and timing create a smooth regular, well-formed bead.

Under cutting is also a result of too much current. No enough current results in overlapping and a lack of fusion with the metal.

Gas-Metal-Arc Welding (MIG):



Gas-shielded arc welding

Although gas-metal-arc (MIG) is the official description of this welding method, the earlier name of metal inert gas (MIG) is still widely used, especially in the shop. Gas-metal-arc welding Figure is a gas shielded metal arc welding process which uses the high heat of an electric arc between a continuously fed consumable electrode wire and the material to be welded. Metal is transferred through protected arc column to the work.

In this process, the wire is fed continuously from a reel through a gun to constant surface which imparts a current upon the wire. A fixed relationship exists between the rate of wire burn-off and the welding current so that welding machine at a given wire feed rate will produce necessary current to maintain the wire and the speed of melting of the wire may be up to 5 m/mm. The welding machine is discontent voltage with both straight and reverse polarities available.

The welding gun be either air-or-water-cooled depending upon the current being used. With the higher amperages, a water-cooled gun is used. The welding wire (continuous electrode) is very often bare. Very lightly coated or flux-cored wire is also used. The wire is usually in diameters of 0.09 to 1.6 mm, however, size up to 3.2mm, are made.
In gas-metal-arc welding, the welding area is flooded with a gas (an inert gas), which will not combine with the metal. The rate of flow this gas is sufficient to keep oxygen of the air away from the hot metal surface while welding is being done. Carbon dioxide is used for working with steel, as GMA is clean, faster method for welding steel. Carbon dioxide is used principally because it is inexpensive. For welding aluminum or copper, argon or argon- helium mixture are used. For stainless steel, MIG welding is done gas shielding, and the copper-nickel and high-nickel alloys use argon-helium mixture.

Some Advantages of this Process are:
(1) No flux required.
(2) High welding speed.
(3) Increased corrosion resistance
(4) Welds all metals including aluminum and stainless steel.
(5) High economy.

CLASS: **ENROLLMENT NO:** **EXERCISE NO:**

Name of material reqd.: Raw material Size:

	Date	Faculty (Sign.)	Store Keeper (Sign.)
Material issued on			
Repeat Material issued on			

WORK DETAILS

Date	Time		Hours	Instructor's Signature	Remarks
	From	To			
Total Hours					

	Date	Instructor (Sign.)	Faculty (Sign.)
Exercise/Job Completed on			
Exercise/Job submitted on			

❖ **Questions**

1. List out types of welding.
2. Differentiate arc welding and gas welding.
3. List out application of welding.
4. Advantage and disadvantage of welding.

Suggested Reference:

References used by the students:

Rubric wise marks obtained:

Rubrics	1	2	3	4	5	Total
Marks						

Experiment No: 6
To study various types of machine tools

Date:

Relevant CO: CO-2

Objectives: To know the different type of machine tools.

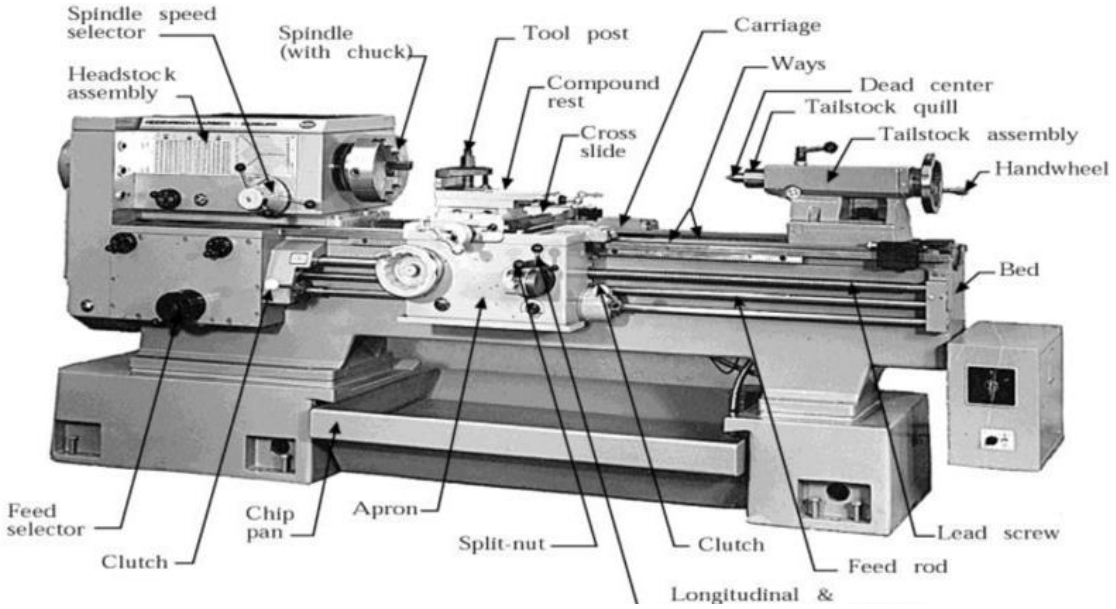
Theory:

Material and components such as cutting at stroke after having been formed to performing shops are finished by various machine represent occurred to resisted dimension also the shaft made from solid steel bar has tracing have the working surface completed and referenced such as their surface completed by power given machine called machine tools.

The machine tools used in machine shop are.

(1)Lathe
(2)Drilling
(3)Milling
(4)Hacksaw
(5)Planner
(6)Shaper

- Lathe: function lathe the function of lathe is to remove metal from a periphery of work to given the required shop and size.
- Lathe parts and its unction: the differ lathe parts are as follow.
  (1) Bed (2) tail stock (3) Feed mechanism (4) Head stock (5) Carriage (6) Screw mechanism



- Bed: the lathe bed forms the base of the machining.
- Head stock: it carried essentially a hollow spindle the mechanism for friction and the spindle.
- Tail stock: to according different length of work body at the tail stock can be adjusted along the desired position when it can be clamped.
- Carriage: it has serve parts that serve to support move and material the cutting from.
- Lathe creations: Head between centers and friction by carriage and clutch plates held driven by check with one another and supported on the tail stoke held and a mandrill which is picture held and driven by check of face plate or an angle plate.
- Drilling: introduction of drilling mechanism the drilling machine is come of the most important machine tools in a work shop are regard it's important it is second only to the lathe in a drilling machine. Lathe may be drilled.

Uses:-

- Straight Turning
- Rough Turning
- Finish Turning
- Step Turning
- Taper Turning
- Eccentric Turning
- Form Turning
- Facing
- Grooving
- Undercutting
- Knurling
- Relieving
- Drilling
- Reaming
- Boring
- Counter Boring
- Taper Boring
- Grinding
- Milling
- Chamfering
- Thread Cutting
- Tapping
- Parting Off
- Spinning
- Spring Winding
- Filing
- Polishing
-

(2) Drilling machine

A drill is a tool used for making round holes or driving fasteners. It is fitted with a bit, either a drill or driver chuck. Hand-operated types are dramatically decreasing in popularity and cordless battery-powered ones proliferating due to increased efficiency and ease of use.

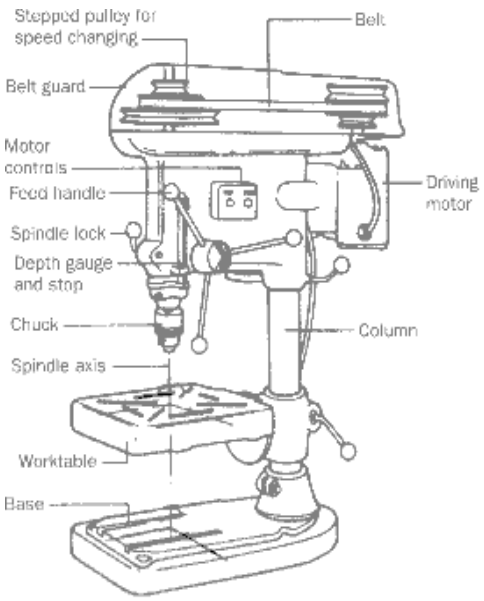
Drills are commonly used in woodworking, metalworking, construction, machine tool fabrication, construction and utility projects. Specially designed versions are made for miniature applications.

❖ **TYPES OF DRILLING MACHINE:**

(1) Portable drilling machine;
(2) Sensitive drilling machine (a)Hence mount (b) hour mounting
(3) Up-right milling machine (a)Round column section (b) box column section
(4) Radial drilling machine (a)Plain (b) universal
(5) Query drilling machine
(6) Multiple spindle drilling machines
(7) Deep hole drilling machine (a)Horizontal (b) Vertical

SIZE OF DRILLING MACHINE:

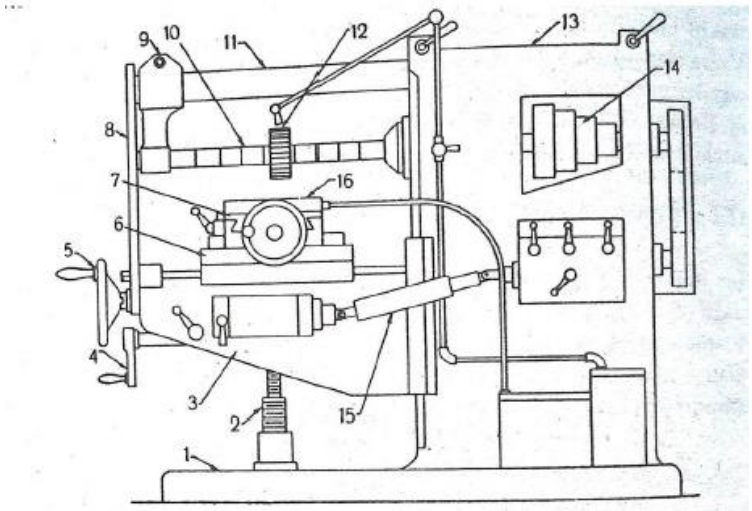
The size of drilling machine various with the types of machine beginning considered a parallel drilling machine is specified by the maximum diameter of the drill that it can held the sensitive and upright by the diameter of machine size at the drill that can table



Uses:-.

- Drilling Operation
- Boring Operation
- Reaming Operation
- Counter boring Operation
- Countersinking Operation
- Tapping Operation
- Spot Facing Operation
- Trepanning Operation and
- Honing Operation

(3) Milling Machine



Column and knee type milling machine

1. Base, 2. Elevating screw, 3. Knee, 4. Knee elevating handle, 5. Crossfeed handle, 6. Saddle, Table, 8. Front brace, 9. Arbor support, 10. Conepulley, 15. Telescopic feed shaft.

Milling is a cutting process that uses a milling cutter to remove material from the surface of a work piece. The milling cutter is a rotary cutting tool, often with multiple cutting points. As opposed to drilling, where the tool is advanced along its rotation axis, the cutter in milling is usually moved perpendicular to its axis so that cutting occurs on the circumference of the cutter. As the milling cutter enters the work piece, the cutting edges (flutes or teeth) of the tool repeatedly cut into and exit from the material, shaving off chips (swarf) from the work piece with each pass. The cutting action is shear deformation; material is pushed off the work piece in tiny clumps that hang together to a greater or lesser extent (depending on the material) to form chips. This makes metal cutting somewhat different (in its mechanics) from slicing softer materials with a blade.

The milling process removes material by performing many separate, small cuts. This is accomplished by using a cutter with many teeth, spinning the cutter at high speed, or advancing the material through the cutter slowly; most often it is some combination of these three approaches.[2] The speeds and feeds used are varied to suit a combination of variables. The speed at which the piece advances through the cutter is called feed rate, or just feed; it is most often measured as distance per time (inches per minute [in/min or ipm] or millimeters per minute [mm/min]), although distance per revolution or per cutter tooth are also sometimes used.

There are two major classes of milling process:

(1) In face milling, the cutting action occurs primarily at the end corners of the milling cutter. Face milling is used to cut flat surfaces (faces) into the work piece, or to cut flat-bottomed cavities.

(2) In peripheral milling, the cutting action occurs primarily along the circumference of the cutter, s

(3) o that the cross section of the milled surface ends up receiving the shape of the cutter. In this case the blades of the cutter can be seen as scooping out material from the work piece. Peripheral milling is well suited to the cutting of deep slots, threads, and gear teeth.

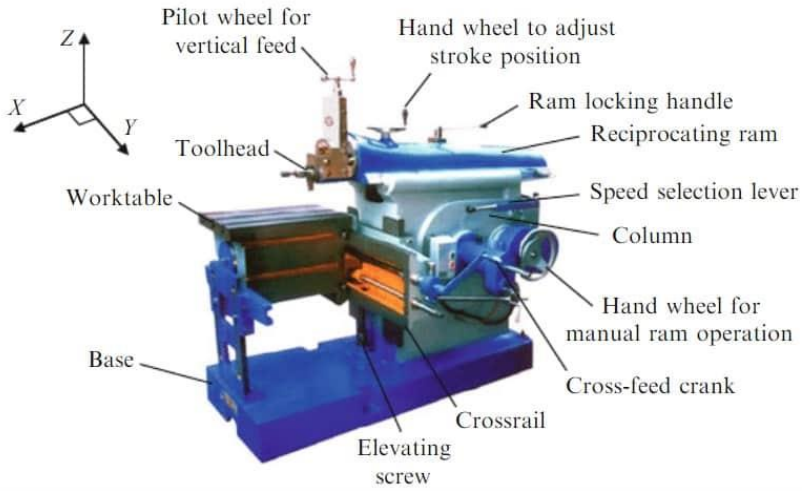
Uses

1. Face Milling
2. Plain Milling
3. Side Milling
4. Straddle Milling
5. Gang Milling
6. Angle Milling
7. Form Milling
8. End Milling
9. Conventional Milling and Climb Milling Operations
10. Saw Milling
11. Milling Keyways, Grooves, and Slots
12. Gear Cutting
13. Thread Milling
14. Cam Milling
15. CNC Milling

(3) Shaper machine

In machining, a shaper is a type of machine tool that uses linear relative motion between the workpiece and a single-point cutting tool to machine a linear toolpath. Its cut is analogous to that of a lathe, except that it is (archetypally) linear instead of helical.

A wood shaper is a functionally different woodworking tool, typically with a powered rotating cutting head and manually fed workpiece, usually known simply as a shaper in North America and spindle moulder in the UK.



A metalworking shaper is somewhat analogous to a metalworking planer, with the cutter riding a ram that moves relative to a stationary workpiece, rather than the workpiece moving beneath the cutter. The ram is typically actuated by a mechanical crank inside the column, though hydraulically actuated shapers are increasingly used. Adding axes of motion to a shaper can yield helical tool paths, as also done in helical planing.

A single-point cutting tool is rigidly held in the tool holder, which is mounted on the ram. The work piece is rigidly held in a vise or clamped directly on the table. The table may be supported at the outer end. The ram reciprocates and the cutting tool, held in the tool holder, moves forwards and backwards over the work piece. In a standard shaper, cutting of material takes place during the forward stroke of the ram and the return stroke remains idle. The return is governed by a quick return mechanism. The depth of the cut increments by moving the workpiece, and the workpiece is fed by a pawl and ratchet mechanism.

Uses:-

- Keyways in the boss of a pulley or gear can be machined without resorting to a dedicated broaching setup.
- Dovetail slides
- Internal splines and gear teeth.
- Keyway, spline, and gear tooth cutting in blind holes
- Smoothing of a rough surface

CLASS: **ENROLLMENT NO:** **EXERCISE NO:**

Name of material reqd.: Raw material Size:

	Date	Faculty (Sign.)	Store Keeper (Sign.)
Material issued on			
Repeat Material issued on			

WORK DETAILS

Date	Time		Hours	Instructor's Signature	Remarks
	From	To			
Total Hours					

	Date	Instructor (Sign.)	Faculty (Sign.)
Exercise/Job Completed on			
Exercise/Job submitted on			

Question:-

1) Draw the detailed sketch of different types of machine tools.
2) List down the different types of operation that can be performed by following types of machine tools.
    a) Lathe machine
    b) Drilling machine
    c) Milling machine
    d) Shaper machine

Suggested Reference:

References used by the students:

Rubric wise marks obtained:

Rubrics	1	2	3	4	5	Total
Marks						