



GOVERNMENT POLYTECHNIC RANCHI
LAB MANUAL
WORKSHOP PRACTICE -1

CARPENTRY SHOP

Carpentry is the process of shaping Timber, using hand tools. The products produced are used in building construction, such as doors and windows, furniture manufacturing, patterns for moulding in foundries, etc. Carpentry work mainly involves the joining together of wooden pieces and finishing the surfaces after shaping them. Hence, the term joining is also used commonly for carpentry. A student studying the fundamentals of wood working has to know about timber and other carpentry materials, wood working tools, carpentry operations and the method of making common types of joints.

1. Materials Used in Carpentry:

Basic materials used in carpentry shop are timber and plywood. Auxiliary materials used are nails, screws, adhesives, paints, varnishes, etc.

Timber:

Timber is the name given to wood obtained from exogenous (outward growing) trees. In these trees, the growth is outward from the centre, by adding almost concentric layers of fresh wood every year known as annual rings. After the full growth, these trees are cut and sawed to convert into rectangular sections of various sizes for engineering purposes.

Timber is available in market in various shapes and size. The common shapes and sizes are given below:

1. **Log:** This is the trunk of the tree which is free from branches.
2. **Balk:** This is the log after sawing roughly to square cross section.
3. **Deal:** This is the log after sawing into rectangular cross section of width about 225 mm and thickness up to 100 mm.
4. **Plank:** This is the timber piece having width more than 275 mm and thickness 50 to 150 mm.
5. **Board:** This is the timber piece below 50 mm in thickness and above 125 mm in width,
6. **Batten:** This is the timber piece below 175 mm in width and thickness between 30 mm to 50 mm in thickness.
7. **Scantlings:** These are timber pieces of various assorted and nonstandard sizes other than the types given above.

2. Classification of Wood

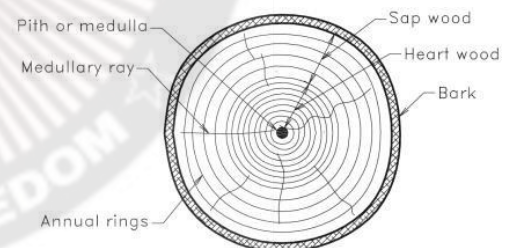
The timber used for commercial purposes can be divided into two classes as soft wood and hard wood

Soft wood

A soft wood is light in weight and light colored. They may have distinct annual rings but the medullary rays (radial lines) are not visible and the color of the *sap wood* (outer layers) is not distinctive from the heart wood (inner layers). These woods cannot resist stresses developed across their fibers; hence, not suitable for wood working.

Hard wood

In this type of wood the annual rings are compact and thin and the medullary rays (radial lines) are visible in most cases Figure 6.1. Hard woods are nearly equally strong both along and across the fibers. Hard wood is the material used for wood working



3. Classification of timber

According to the manner of growth of trees, timber can be classified as

- i) Exogenous or outward growing
 - ii) Endogenous or inward growing
- i) Exogenous or outward growing**

In exogenous trees the growth takes place from the centre by the addition of concentric layers of fresh wood every year, known as annual rings. These varieties of trees are suitable for building and other engineering uses. The exogenous trees are again classified as

- a) Conifers or ever green trees
- b) Deciduous or broad leaf trees



The conifer give soft woods and the deciduous gives hard wood common example of hard wood are Sal, teak, rose wood, sandal, shisham, oak beach, ash ebony, mango, neem, babool, etc., soft wood include kail pine, deodar chair, walnut seemal etc.

ii) Endogenous or in ward growing timber

These trees grow in wards i.e. every fresh layer of sap wood is added inside instead of outside cane, bamboo, coconut

Seasoning

Seasoning of wood carried out for removing the sap and reducing the moisture content the presence of sap and moisture will render the wood unsuitable for engineering works due to uneven shrinkage, crack, wrapping and decay.

Different methods of seasoning

1. Air seasoning or Natural seasoning
2. Water seasoning
3. Electrical seasoning
4. Kiln seasoning

Ply wood

Thick sheet formed by pasting veneers of wood is called ply. Three or more plys joined by glues is called plywood. The grains of adjacent layers are kept at right angle to each other in order to get better strengthening both directions the outer layer are called facing plys and good hard wood veneers are used for this inner ones are called core plys and low quality wood is used for this the ply wood is made by either cold pressing or hot pressing.

4. Tools for wood working

The principle hand tools used in a carpentry workshop can be classified into

- i) Marking and measuring tool
- ii) Cutting tool
- iii) Planning tool
- iv) Boring tool
- v) Striking tool
- vi) Holding tool

Marking and measuring tool

a) Rules

Rules are used for measuring dimensions. For measuring and setting out dimensions various types of rules are used in carpentry shop. Steel Rule- Stainless Steel Rule of length 30cm and 60cm. Flexible Measuring Rule- for measuring large dimensions as well as curved or angular surface dimensions.

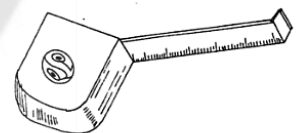
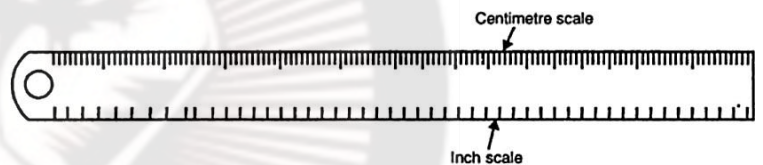


Fig. 21. Measuring steel tape.

b) Straight Edge and Squares

This is a machined flat piece wood or metal having perfectly straight and parallel edges.

c) Steel Tape: It is used for large dimensions, such as marking on boards and checking the overall dimensions of the work.

d) Gauges

Gauges are used to mark lines parallel to the edges of a wooden piece. It mainly consists of a wooden stem sliding inside a wooden stock. The stem carries a steel point for marking lines. The stock position on the stem can be varied and fixed rigidly by tightening the thumb screw.

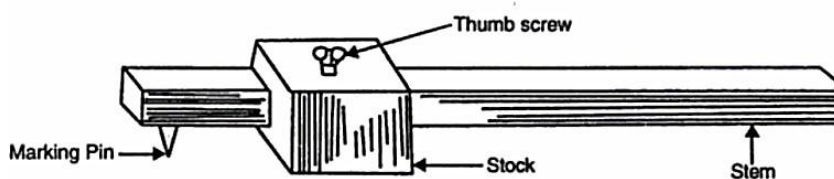


Fig. Marking Gauge



To mark a line parallel to an edge the gauge stock is held freely against the edge and pushed along it, pressing the steel points to the surface

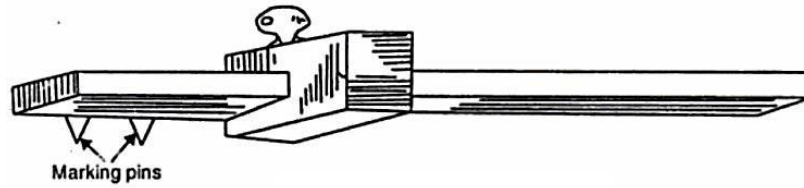


Fig. Mortise Gauge

c) Try square

Try square consists of rectangular steel blade fixed rigidly to cast iron stock. The length of blade varies from 150mm to 300mm.

5. Marking Knife or Scriber

Marking Knives are used to convert the pencil lines drawn on the wooden surface into deep scratch lines on the surface. They are made of steel with a sharp point at one end and flat blade at the other end.



Fig. Marking Knife

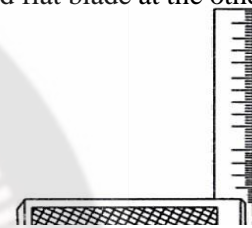


Fig. Try Square

Bevel Square: it is also called sliding level. It is an adjustable try-square is used for measuring/marketing angles between 0° and 180°.

6. Holdingtools

a) Work Bench

This is a table of having size and raised construction made of hard wood. The size ranges from 50- 80 cm in length and about 90cm in width. Two or four carpenters can work at a time on the work bench.

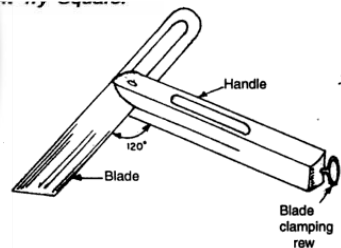


Fig. Bevel Square

7. Carpenters Bench Vice

It consists of jaw fixed on the table side and movable jaw kept in position by means of screw and handle. The body of vice is made of cast iron or steel. The jaws are lined with hard wood which can be removed when it is damaged.

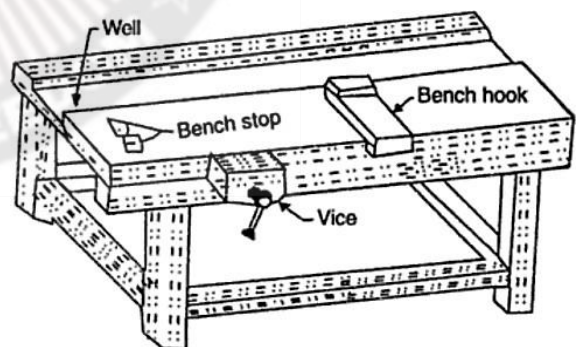


Fig. Work Bench with Bench Hook

a) Sash-cramp

The screw moves inside the fixed half nut which can be engaged or disengaged by operating the lever. This is made up of a bar of steel. The work is clamped between jaws by rotating the screw using the handle. It is used for clamping glued pieces or holding the work piece of larger size together for various operations.



- b) **C Clamp:** The clamp of the shape of letter C or G is used to clamp short pieces together as the bar clamp. These clamps are available in sizes varying from 70 mm to 800 mm. It is used for holding the planks after gluing

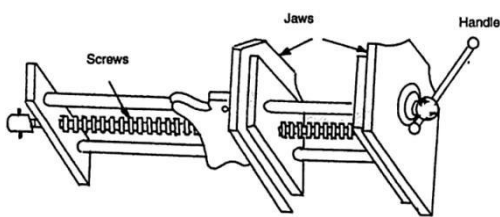


Fig. Carpenters Bench Vice

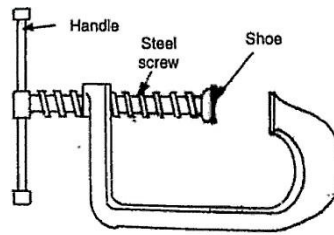


Fig. 1.32. C-clamp.



Fig. Bar or T-Cramp

Bar or T-cramp: it consists of a steel bar fitted with a threaded spindle and an adjustable shoe. It is used for holding the glued pieces tightly or holding firmly two or more unglued pieces for fitting dowels or doing other operations on them in assembled position.

8. Cutting tools

a) Saws

Saw is a cutting tool which has teeth on one edge and cutting is affected by reciprocating motion of the edge relative to the work piece. Cutting occurs during the forward motion; such a saw is called push type saw, the cutting occurs during the backward motion.

- i. **Hand Saw-** This saw is used for short straight cuts. It has a blade of 25-40cm length 6-10cm width. The number of teeth per cm length ranges from 3-5.
- ii. **Tenon Saw (Back Saw)-** It has a parallel blade of 25-40cm length and 6-10cm width. The number of teeth per cm length ranges from 5-8.

b) Chisels

The common type of chisels used is briefly explained below.

- i. **Firmer Chisels-** they are most common and general purpose chisel used by a carpenter. They have flat blade of 15-50mm width and 125mm length.
- ii. **Dove Tail Chisel (beveled edge firmer chisel) -** These chisels are used for fine and delicate works as well as for cutting corners.
- iii. **Mortise chisel –** These chisels are used for heavy and deep cut to remove large quantity of wood. These chisels have width of about 15mm but the blade thickness may range from 6-15mm.

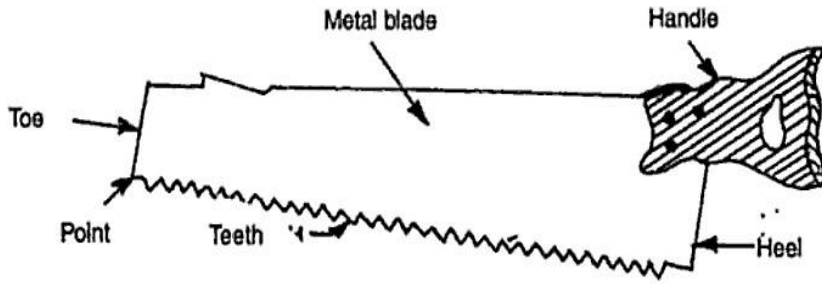


Fig. Parts of Saw

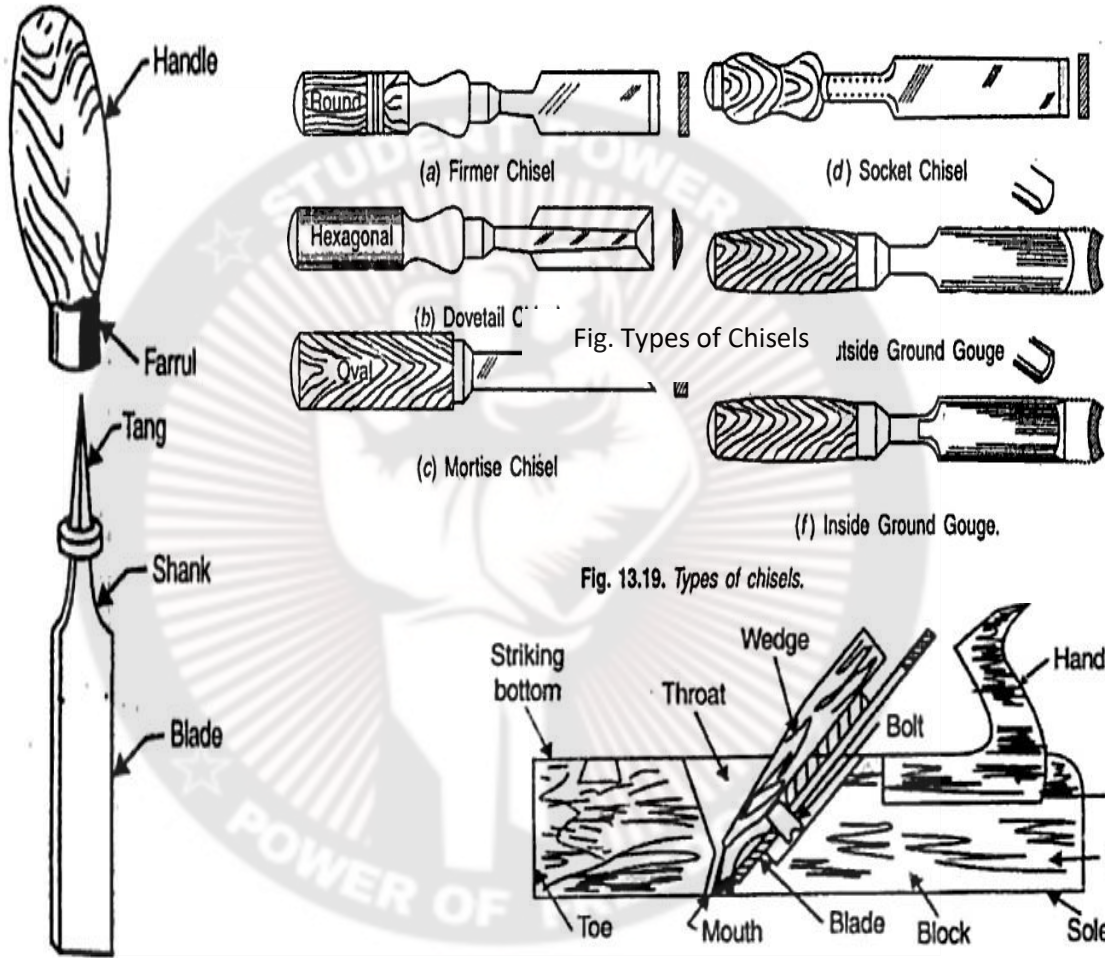
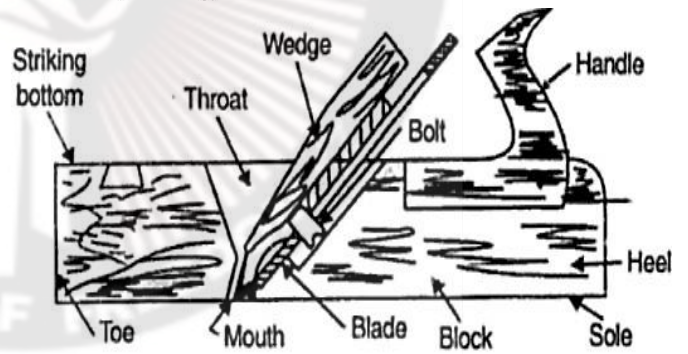


Fig. 13.19. Types of chisels.



(a) Wooden Jack Plane (Sectional View)

Fig. 13.18. Parts of a Chisel.



9. Planing Tools

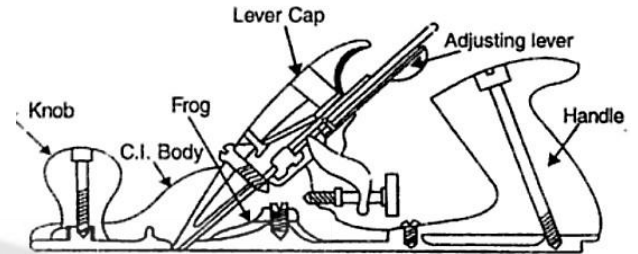
Planing tool is used to smoothen the wooden surfaces.

a) Wooden jack plane

This is the most commonly used plane in carpentry shop. The main part of a wooden jack plane is a wooden block called sole, in which steel blade having knife edge is fixed at an angle with the help of wooden edge. The angle of the blade is kept about 45° to bottom surface of the blade.

b) Metal Jack Plane

It serves the same purpose as the wooden jack plane but facilitates a smoother operations and better finish. The body of a metal jack plane is made from a grey iron casting with the side and sole machined and ground to better finish.



(c) Iron Jack Plane (Sectional View)

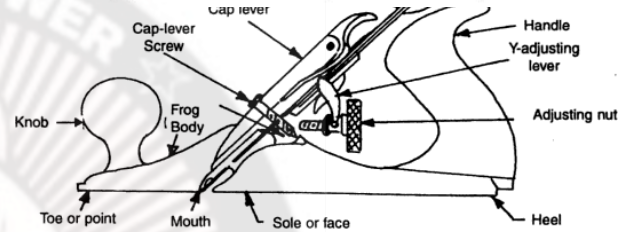


Fig. Plane

10. DRILLING AND BORING TOOLS:

a) **Bradawl:** It is a hand operated tool, used to bore small holes for starting a screw or large nail.

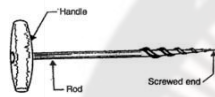


Fig. Gimlet Drill



b) **Carpenters brace:** it is used for rotating auger bits, twist drills, etc., to produce holes in wood. In some designs, braces are made with ratchet device.

c) **Auger bit:** it is the most common tool used for making holes in wood. During drilling, the lead screw of the bit guides into the wood, necessitating only moderate pressure on the brace. The helical flutes on the surface carry the chips to the outer surface.

d) **Hand drill:** carpenter's brace is used to make relatively large size holes; whereas hand drill is used for drilling small holes. A straight shank drill is used with this tool. It is small, light in weight and may be conveniently used than the brace. The drill bit is clamped in the chuck at its end and is rotated by a handle attached to gear and pinion arrangement.

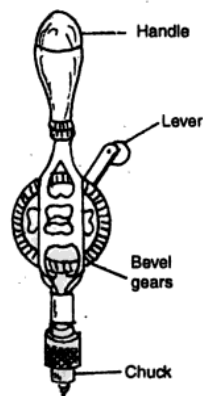


Fig. 55. Hand drill.

e) **Gimlet:** it has cutting edges like a twist drill. It is used for drilling large diameter holes with the hand pressure.

11. Striking Tools

a) Mallet

This is wooden headed hammer of round or rectangular cross section. The striking face is made flat. Mallet is used for striking the cutting tools and has wooden handle.

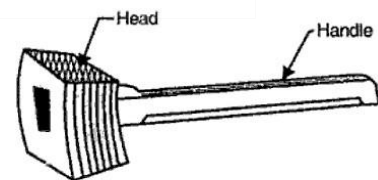


Fig. 13.28. Mallet.

b) Claw Hammer

This is a hammer having steel head and wooden handle. The flat face of the head is used for driving nails and claw portion for extracting nails out of the wood.



Fig. 60. Pincer.

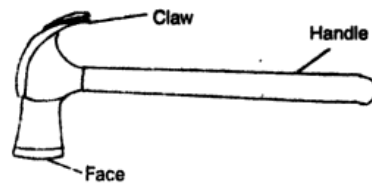


Fig. Claw Hammer

c) **Pincer:** it is made of two forged steel arms with a hinged joint and is used for pulling-out small nails from wood. The inner faces of the pincer jaws are bevelled and the outer faces are plain. The end of one arm has a ball and the other has a claw. The bevelled jaws and the claw are used for pulling out smallnails, pins and screws from the wood.

d) **Screw Driver:** it is used for driving wood screws into wood or unscrewing them. The length of a screw driver is determined by the length of the blade. As the length of the blade increases, the width and thickness of the tip also increase.

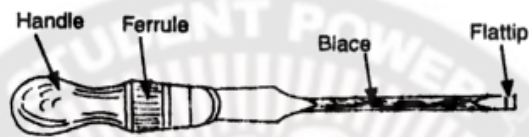


Fig. Screw Driver

e) **Wood rasp files:** it is a finishing tool used to make the wood surface smooth, remove sharp edges, and finish fillets and other interior surfaces. Sharp cutting teeth are provided on its surface for the purpose. This file is exclusively used in wood work.



Fig. Wood Rasp files



Experiment No: 1

Aim: To make a 'T' lap joint

Material Size: (250 x50x50) mm

Tools and equipments Required:

1. Steel Rule
2. Try square
3. Marking gauge
4. Rip saw
5. Firmer chisel
6. Rasp cut file
7. Claw Hammer
8. Tack planner

Sequence of Operations:

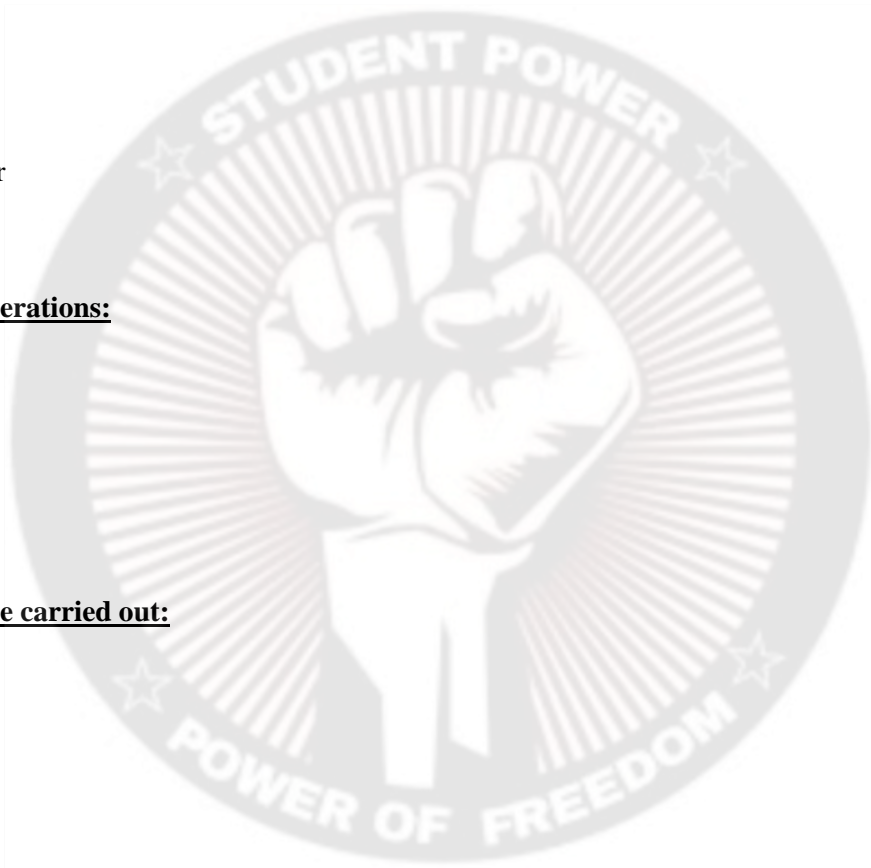
1. Cutting
2. Planing
3. Inspection

Operations to be carried out:

1. Planning
2. Measuring
3. Marking
4. Sawing
5. Chiseling
6. Finishing

Procedure:

1. Check the raw material as per given dimension.
2. The wooden pieces are made into two halves and are checked for dimensions.
3. One side of pieces is planned with the help of rasp cut file for straightness.
4. Adjacent side is planned and checked for squareness with the try square.





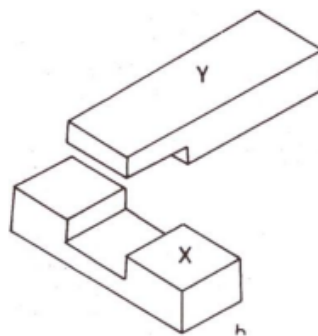
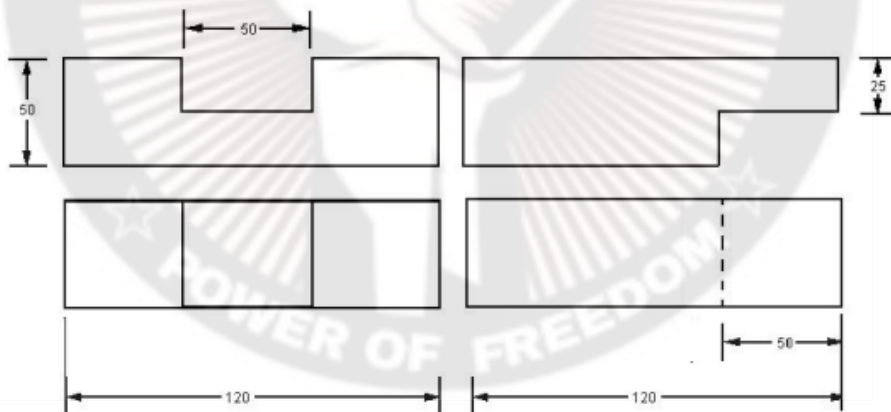
5. Marking gauge is set and lines are marked at 40mm to make thickness, width and length according to given figure dimension.
6. The excess material is planned to correct size.
7. Using Rip saw the portion to be removed are cut in both pieces.
8. The excess material in part X is chiseled with firmer chisel.
9. The excess material in part Y is chiseled to suit X.
10. The end of both the pieces is finished as per given dimensions.

SAFETY PRECAUTION

1. Wood should be free from moisture.
2. Marking is done with parallax error.
3. Care should be taken while chiseling and sawing.
4. Matching of X and Y pieces should be tight.

RESULT

The T lap joint is made successfully.





Experiment No: 2

Aim: To make a Dovetail lap joint

Material Size: (250 x50x50) mm

Tools and equipments Required:

1. Steel Rule
2. Try square
3. Marking gauge
4. Rip saw
5. Firmer chisel
6. Rasp cut file
7. Claw Hammer
8. Tack planner

Sequence of Operations:

1. Cutting
2. Planing
3. Inspection

Operations to be carried out:

1. Planning
2. Measuring
3. Marking
4. Sawing
5. Chiseling
6. Finishing

Procedure:

1. Check the raw material as per given dimension.
2. The wooden pieces are made into two halves and are checked for dimensions.
3. One side of pieces is planned with the help of Jack plane for straightness.
4. One adjacent side is planned and checked for squareness with the try square.
5. Marking gauge is set and lines are marked at 40mm to make thickness, width and length according to given

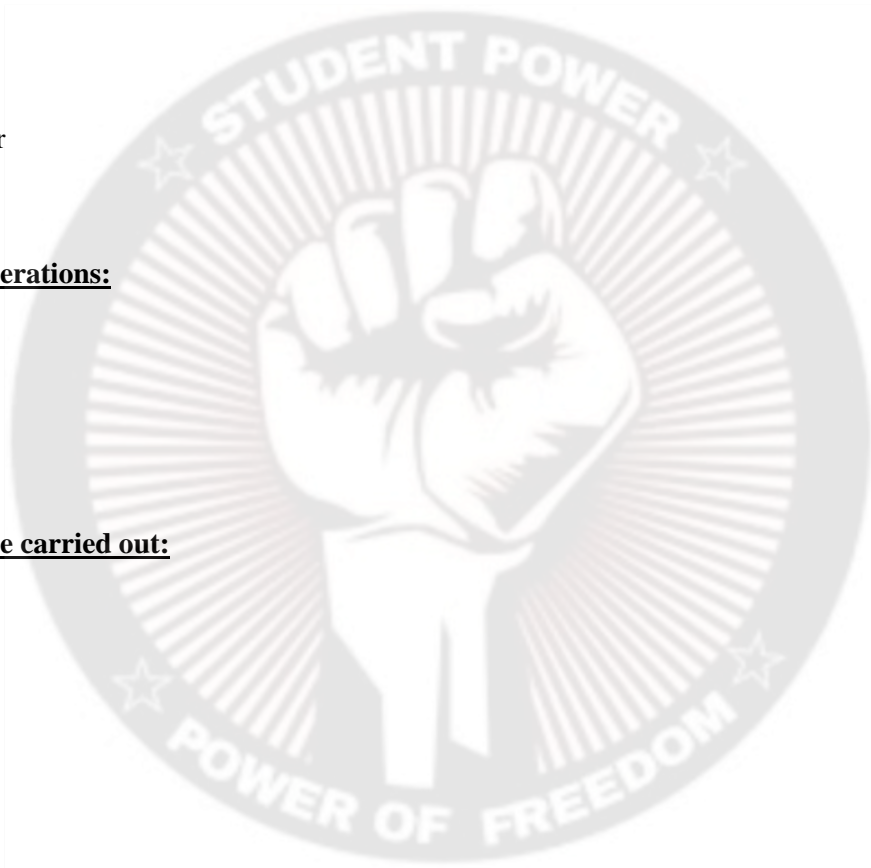


figure dimension.

6. The excess material is planned to correct size.
7. Using Rip saw the portion to be removed are cut in both pieces.
8. The excess material in part X is chiseled with firmer chisel.
9. The excess material in part Y is chiseled to suit X.
10. The end of both the pieces is chiseled to exact length.

SAFETY PRECAUTION

1. Wood should be free from moisture.
2. Marking is done with parallax error.
3. Care should be taken while chiseling and sawing.
4. Matching of X and Y pieces should be tight.

RESULT

The Dove tail lap joint is made successfully.

