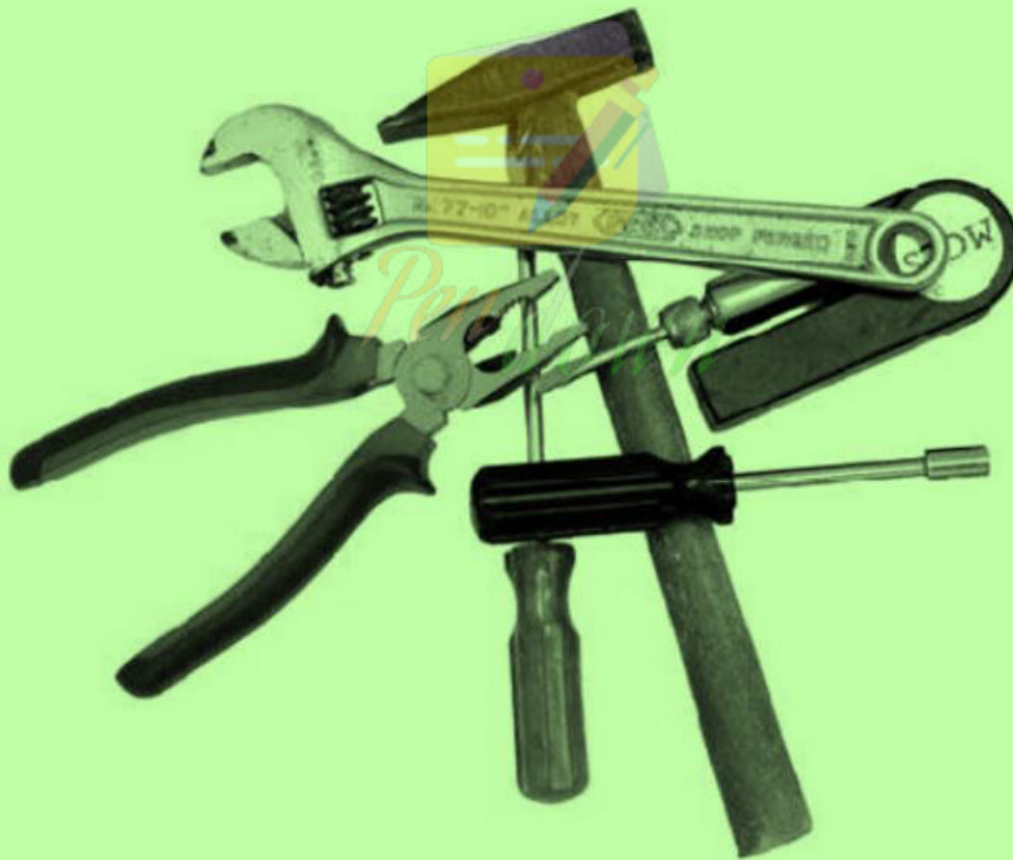


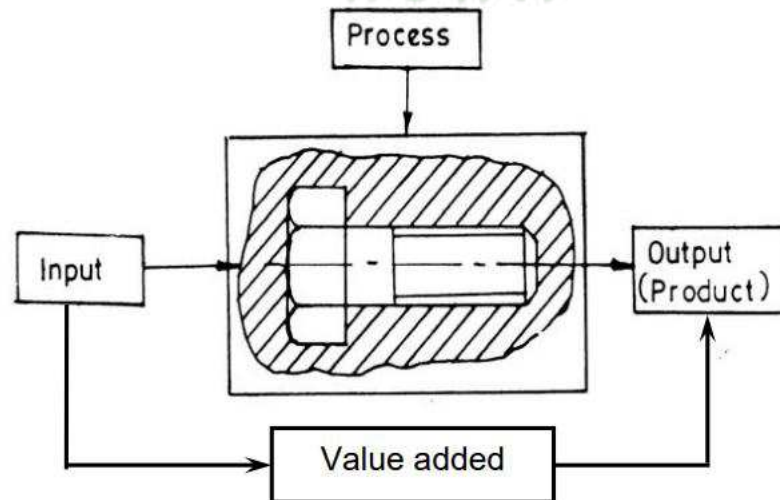
WORKSHOP PRACTICE

An Introduction

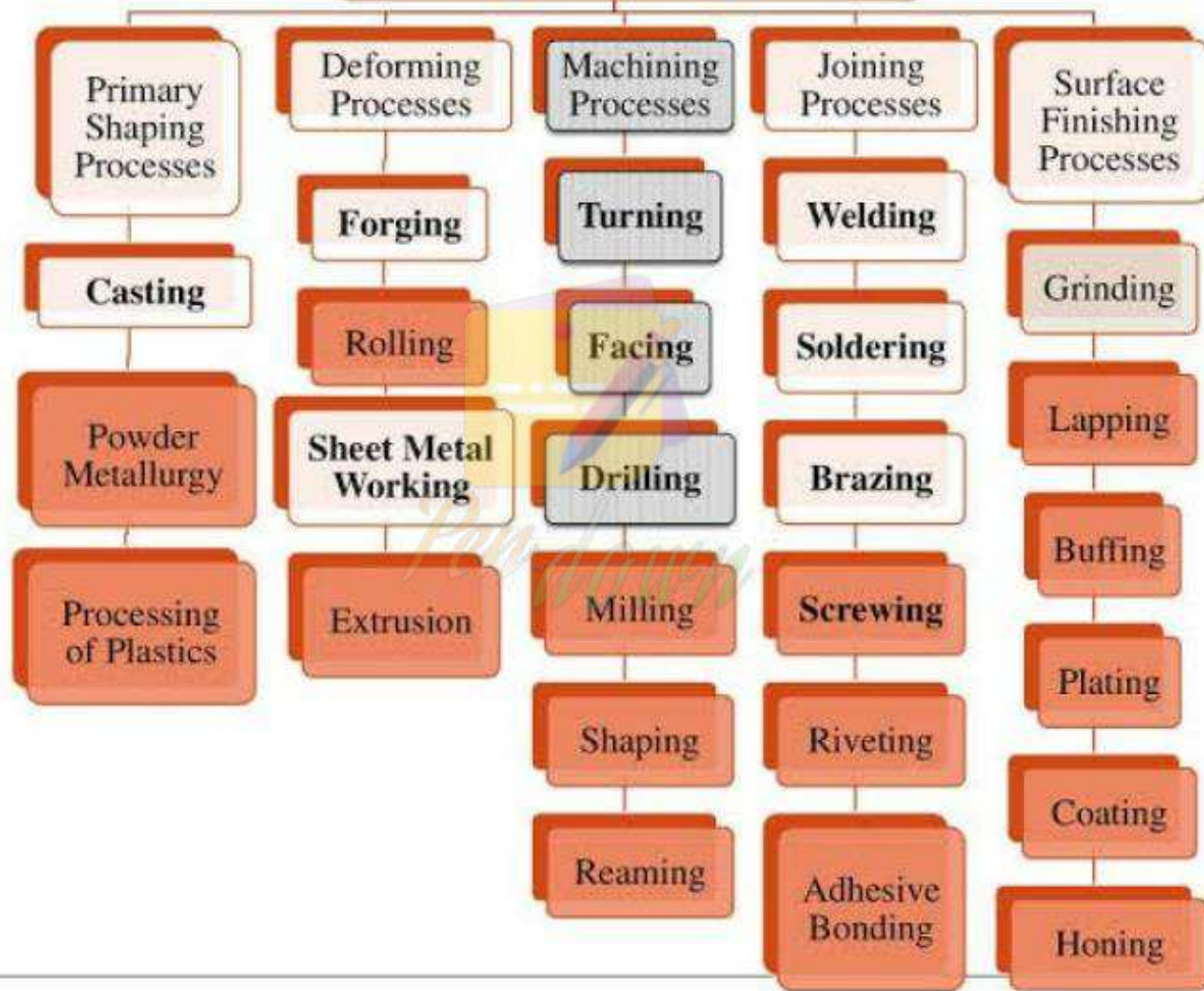


Production or manufacturing

- It can be simply defined as value addition processes by which raw materials of low utility and value due to its inadequate material properties and poor or irregular size, shape and finish are converted into high utility and valued products with definite dimensions, forms and finish imparting some functional ability.
- A lump of mild steel of irregular shape, dimensions and surface, which had almost no use and value, has been converted into a useful and valuable product like bolt by a manufacturing process which imparted suitable features, dimensional accuracy and surface finish, required for fulfilling some functional requirements.



Manufacturing Processes.



WHAT IS WORKSHOP PRACTICE ?

- Workshop practise gives the basic working knowledge required for the production of various engineering products.
- It explains the construction, function, use and application of different working tools, equipment, machines as well as the technique of manufacturing a product from its raw material.

SCOPE AND OBJECTIVES

- In order to gain a good basic knowledge of manufacturing process, a student entering the first year of engineering degree, should undergo a course on workshop practice.
- In order to have a balanced overall development of budding engineers, it is necessary to integrate theory with practice.
- General workshop practices are included in the curriculum in order to provide hands on experience about use of different engineering materials, tools , equipments and processes that are common in the engineering field.
- Besides above, the development of dignity of labour, precision, safety at work place, team working and development of right attitude are the other objectives.



Mechanical Workshop at MNNIT, Pyaragraj (Allahabad)

SHOPS PRESENT IN WORKSHOP

- ☐ CARPENTRY SHOP
- ☐ FOUNDRY SHOP
- ☐ MACHINE SHOP
- ☐ WELDING SHOP
- ☐ SHEET METAL SHOP
- ☐ FITTING SHOP
- ☐ BLACK SMITHY SHOP



Pen down

Carpentry

- Carpentry may be defined as the process of making wooden components. It starts from a marketable form of wood and ends with finished products. It deals with the building work, furniture, cabinet making, etc.
- Joinery, i.e., preparation of joints is one of the important operations in all woodworks. It deals with the specific work of carpenter like making different types of joints to form a finished product.



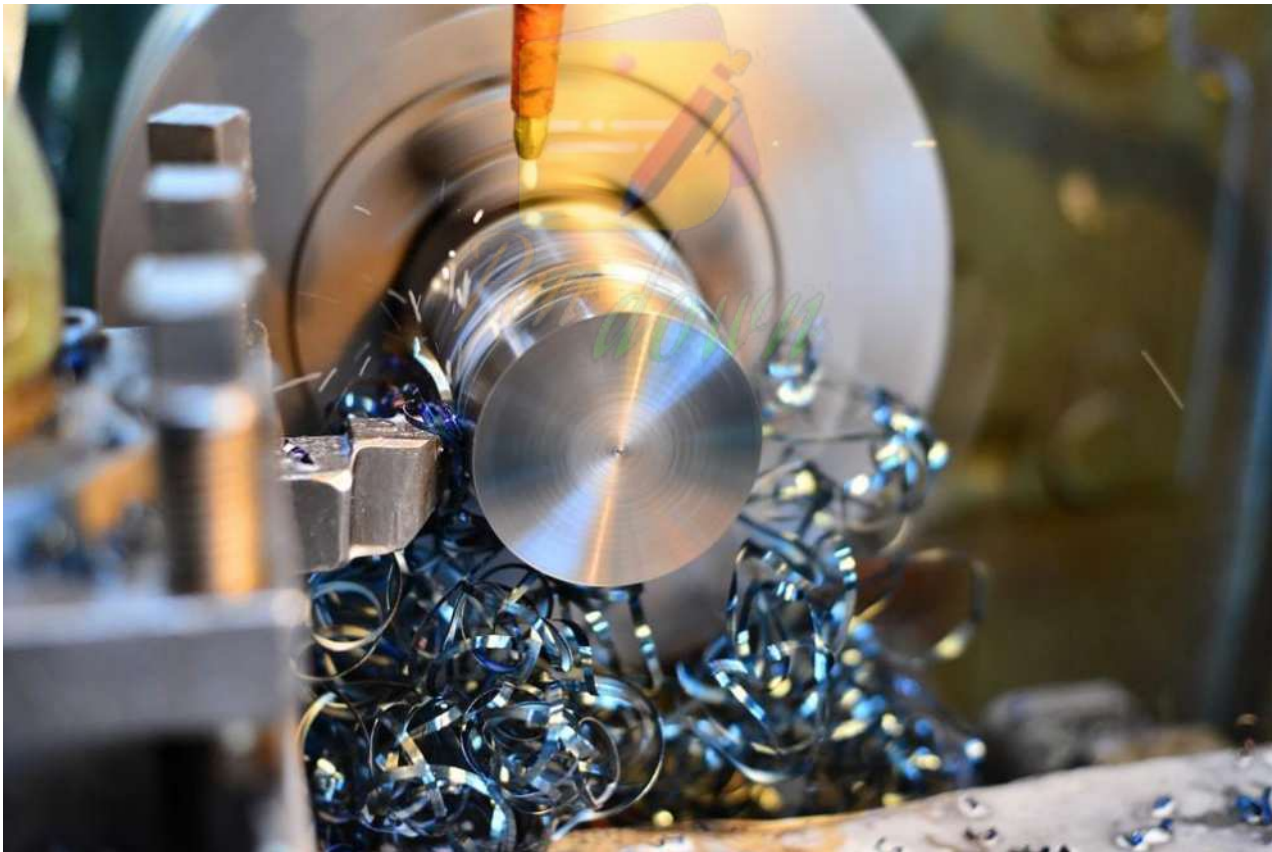
Foundry

- Foundry practice deals with the process of making casting in moulds, formed in either sand or other material.
- This is found to be the cheapest method of metal shaping.
- The process involves the operations of pattern making, sand preparation, molding, melting of metals, pouring in moulds, cooling, shake out, fettling, heat treatment, finishing, and inspection.
- Mould is a cavity in a molding core, formed by a pattern. It is similar in shape and size that of the actual casting plus some allowance for shrinkage, machining etc., molding is the process of making molds.



Machine shop

- A machine shop is a room, building, or company where machining is done, which is a form of subtractive manufacturing. In a machine shop, machinists use machine tools and cutting tools to make parts, usually of metal or plastic (but sometimes of other materials such as glass or wood).



Blacksmithy

- Blacksmithy or hand forging is an ancient trade. It consists of heating a metal stock till it acquires sufficient plasticity; followed by hand forging involving hammering bending pressing etc., till the desired shape is attained.



Welding

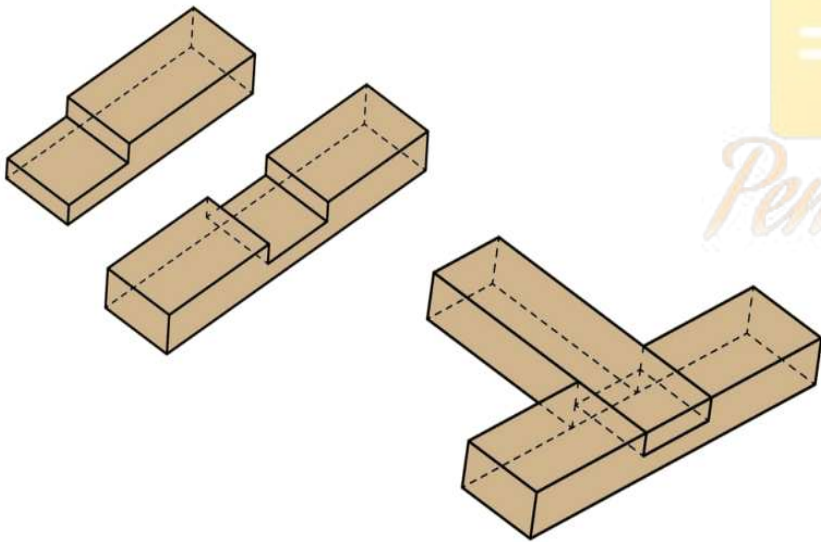
Welding is the process of joining similar or dissimilar metals by the application of heat, with or without application of pressure or filler metal, in such a way that the joint is equivalent in composition and characteristics of the metals joined.

In the beginning welding was mainly used for repairing all kinds of worn or damaged parts. Now, it is extensively used in manufacturing industry, construction industry (construction of ships, tanks, locomotives and automobiles) and maintenance work, replacing riveting and bolting to a greater extent.



Fitting

- Fitting deals with the assembly of mating parts, through removal of metal, to obtain the required fit.



Sheet Metal Working

- It deals with the working of metal sheets.
- Operations: Cutting, shearing, and bending, etc.



General Workshop Safety Rules

- Safety glasses must be worn at all times while working with tools.
- Do not wear gloves, loose-fitting clothing, baggy sleeves, dangling jewellery, or neck ties that could become entangled in machinery.
- Remove rings and loose jewellery before operating machinery they can be a hazard.
- Long hair has to be tied up including fringes.
- Safety boots or enclosed shoes must be worn in the workshop. Do not enter under any circumstances without this footwear.

- Operation of power tools and other potentially dangerous shop work may only be done under the supervision of a Workshop Operator/ Foreman.
- Immediately notify the workshop operator/foreman of any faulty or broken equipment.
- You may not use any power tool until you have been trained in safe operation techniques by a Workshop Operator/ Foreman.
- Disconnect power before making adjustments to power tools.
- Do not service energized equipment.
- Take appropriate steps to prevent release of dusts or noxious fumes.

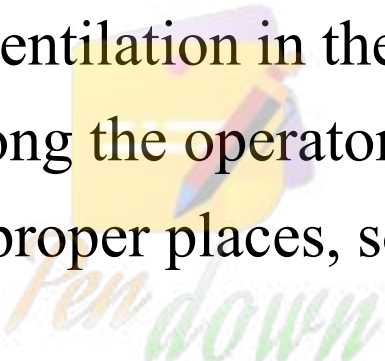
- Take appropriate fire prevention precautions when your work generates heat or sparks, or involves open flames or flammable liquids.
- Do not remove machine guards. Keep shop clean and tidy.
- When not in use, store tools, equipment, and supplies properly. Clean-up after you complete your work.
- When students are operating machinery all other students are to stay clear and not to talk to the operator. If you feel uneasy or unsafe operating any tools or machinery in the workshop, inform the workshop operator/Foreman and help will be provided.
- Follow safety rules of individual shops or equipment.

ACCIDENTS AND THEIR CAUSES

An accident is an unplanned incident which can cause damage to property or injury to people.

It can happen due to any one of the following reasons:

1. Carelessness of the operator.
2. Lack of knowledge of the operator about the machine tool or job.
3. Lack of interest in the work.
4. Excessive confidence of the operator.
5. Operating a faulty machine.

6. Use of improper tools.
 7. Running the machines at higher speeds or higher loads than recommended.
 8. Improper or loose dress of the operator.
 9. Improper lighting and ventilation in the workshop.
 10. Lack of discipline among the operators.
 11. Keeping objects in improper places, so as to interfere with free movement.
- 



CARPENTRY

Pen down

INTRODUCTION

- Carpentry deals with the constructional work such as making roofs, floors, partitions, etc. of building by means of wood with the help of carpentry tools.
- Joinery is term used for connecting the wooden parts with different joints.
- Carpentry shop deals with the working with wood for various applications. A student have to study commonly used carpentry joints such as Cross lap joint, Tee joint, Dovetail joint, Mortise & tenon joint etc.





CLASSIFICATION OF TREES

- Depending on the mode of growth trees are classified into two categories as:
 - a. Endogenous
 - b. Exogenous
- a. **Endogenous trees:**
 - The trees that grow inwards in a longitudinal fibrous mass such as banana, bamboo, palm and cane.
 - Even though the stem of trees of this class is light and though yet it is too flexible that it is not suitable for engineering works with exception to bamboo.

b. Exogenous trees:

- The trees that grow outward by the addition of one concentric ring every year. These rings are known as annual ring.
- Since one ring is added to the tree every year so the number of annual rings in the stem of tree indicates its age in years.
- The timber obtained from this class of trees is extensively used in engineering works.

TIMBER:

Timber is the material used for carpentry and joinery work. It is the wood obtained from exogenous trees by cutting these trees after their full growth.

The word, 'grain', as applied to wood, refers to the appearance or pattern of the wood on the cut surfaces



TERMS RELATED TO TIMBER:

i) Standing or stationary timber:

It is the timber available from a living tree.

ii) Green timber :

It is the freshly fallen tree that has not lost much moisture or timber which still contains free water in its cell.

iii) Rough timber:

It is the timber after falling off the tree.

iv) Converted timber:

It is the timber that has been sawn or prepared into various market sizes. Such as planks, Beams, Battens, etc.

v) Dressed timber:

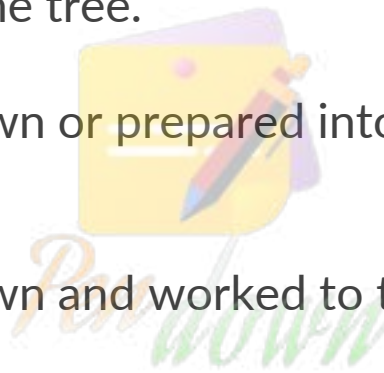
It is the timber that has been sawn and worked to the exact required condition.

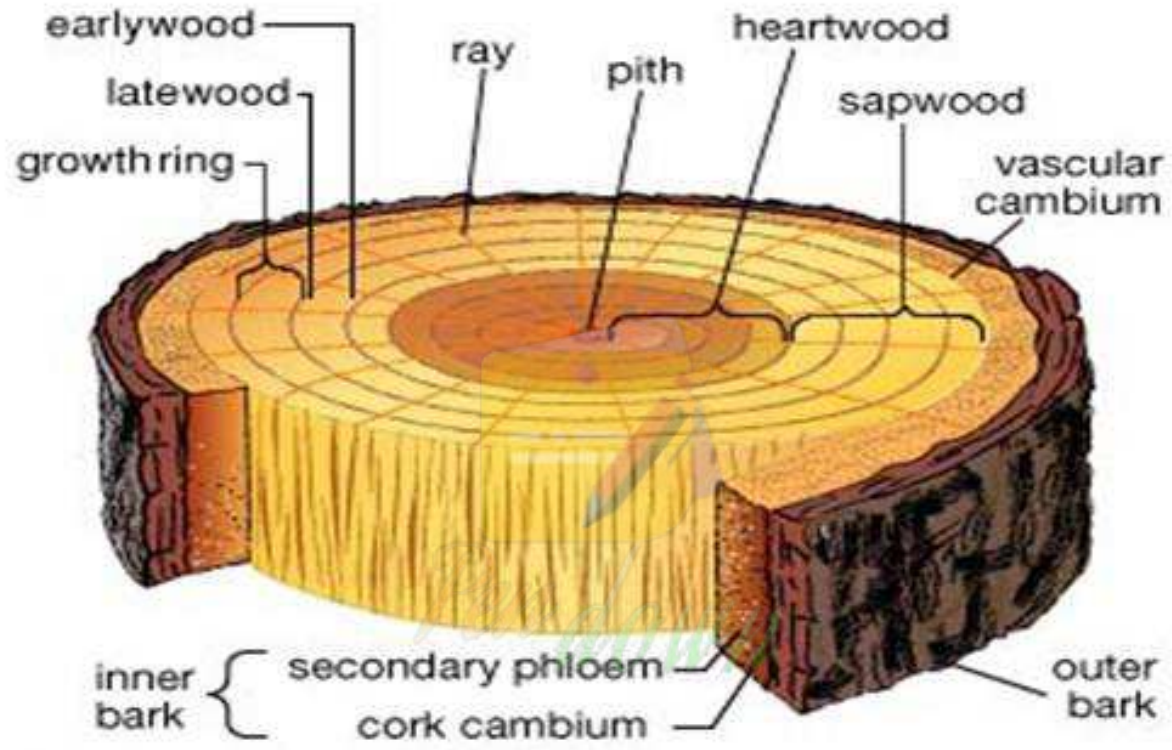
vi) Structural timber:

It is the timber used in framing and load-bearing structure.

vii) Clean timber:

It is the timber free from defects, defects, blemishes.





MARKET SIZES OF TIMBER:

Timber is sold in the market in various standard shapes and sizes. The following are the common shapes and sizes:

1. **Log** - The trunk of the tree, which is free from branches.
2. **Balk** - The log, sawn to have roughly square cross-section.



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3. **Plank** - A sawn timber piece, with more than 275 mm in width, 50 to 150 mm in thickness and 2.5 to 6.5 meters in length.



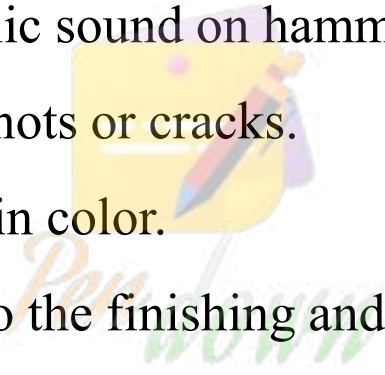
CLASSIFICATION OF TIMBER: Wood suitable for construction and other engineering purposes is called timber. Woods in general are divided into two broad categories: Soft woods and hard woods.

Soft woods are obtained from conifers, kair, deodar, chir, walnut.

Woods obtained from teak, sal, oak, shisham, beach, ash, mango, neem and babul are known as hard woods.

SEASONING OF WOOD: A newly felled tree contains considerable moisture content. If this is not removed, the timber is likely to warp, shrink, crack or decay. Seasoning is the art of extracting the moisture content under controlled conditions

CHARACTERISTICS OF GOOD TIMBER

1. It should have minimum moisture content.
 2. The grains of wood should be straight and long.
 3. It should produce metallic sound on hammering.
 4. It should be free from knots or cracks.
 5. It should be of uniform in color.
 6. It should respond well to the finishing and polishing operations.
- 

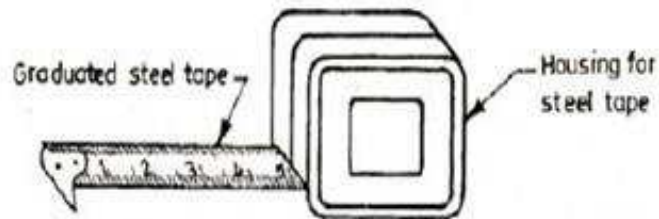
CARPENTRY TOOLS

MARKING AND MEASURING TOOLS:

Accurate marking and measurement is very essential in carpentry work, to produce parts to exact size. To transfer dimensions onto the work; the following are the marking and measuring tools that are required in a carpentry shop:



Steel rule

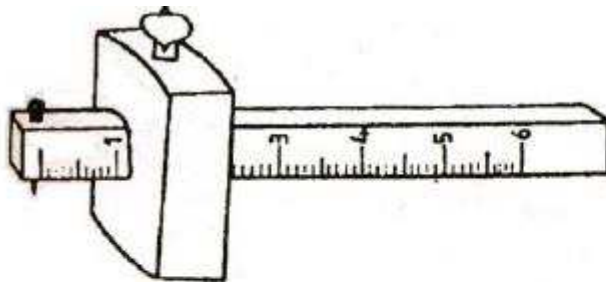


Steel rule and Steel tape

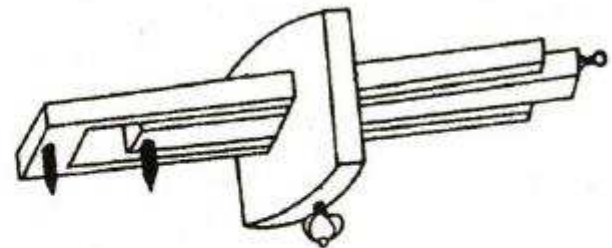
MARKING GAUGE:

It is a tool used to mark lines parallel to the edge of a wooden piece. It consists of a square wooden stem with a sliding wooden stock (head) on it. On the stem is fitted a marking pin, made of steel. The stock is set at any desired distance from the marking point and fixed in position by a screw. It must be ensured that the marking pin project through the stem, about 3 mm and the end is sharp enough to make a very fine line.

MORTISE GAUGE: It consists of two pins. In this, it is possible to adjust the distance between the pins, to draw two parallel lines on the stock.



a. Marking gauge



b. Mortise gauge

Marking gauges

COMPASS AND DIVIDER: It is used for marking arcs and circles on the planed surfaces of the wood.



SCRIBER OR MARKING KNIFE: It is used for marking on timber. It is made of steel, having one end pointed and the other end formed into a sharp cutting edge.



BEVEL SQUARE: It is used for laying-out and checking angles. The blade of the bevel is adjustable and may be held in place by a thumb screw. After it is set to the desired angle, it can be used in much the same way as a try-square. A good way to set it to the required angle is to mark the angle on a surface and then adjust the blade to fit the angle.



Bevel



Try-square

HOLDING TOOLS

CARPENTER'S BENCH VICE: It is used as a work holding device in a carpenter shop. It's one jaw is fixed to the side of the table while the other is movable by means of a screw and a handle. The jaws are lined with hard wooden faces.



C-CLAMP: The clamp of the shape of letter C or G is used to clamp short pieces together as the bar clamp.



BAR CRAMP: It is made of steel bar of T-section, with malleable iron fittings and a steel screw. It is used for holding wide works such as frames or tops.



PLANING TOOLS

JACK PLANE: It is the most commonly used general purpose plane. It is about 35 cm long. The cutting iron (blade) should have a cutting edge of slight curvature. It is used for quick removal of material on rough work and is also used in oblique planing.



SMOOTHING PLANE: It is used for finishing work and hence, the blade should have a straight cutting edge. It is about 20 to 25 cm long. Being short, it can follow even the slight depressions in the stock, better than the jack plane. It is used after using the jack plane.



REBATE PLANE: It is used for making a rebate. A rebate is a recess along the edge of a piece of wood, which is generally used for positioning glass in frames and doors.



PLOUGH PLANE: It is used to cut grooves, which are used to fix panels in a door.



CUTTING TOOLS

SAWS: A saw is used to cut wood into pieces. There are different types of saws, designed to suit different purposes. A saw is specified by the length of its toothed edge.

CROSS-CUT OR HAND SAW: It is used to cut across the grains of the stock. The teeth are so set that the saw kerf will be wider than the blade thickness .

RIP SAW: It is used for cutting the stock along the grains. The cutting edge of this saw makes a steeper angle, i.e., about 60° .



a - Cross cut saw



b - Cross cut saw teeth



c - Rip saw teeth

Cross-cut and rip saw

TENON SAW: It is used for cutting the stock either along or across the grains. It is used for cutting tenons and in fine cabinet work.



COMPASS SAW A compass saw (also called a keyhole saw) has a long tapered blade and a curved handle. A compass saw is designed for cutting curves or working in awkward and confined spaces where a larger saw could not fit



CHISELS

FIRMER CHISEL: The word 'firmer' means 'stronger' and hence firmer chisel is stronger than other chisels. It is a general purpose chisel and is used either by hand pressure or by a mallet. The blade of a firmer chisel is flat, as shown in the figure.



DOVETAIL CHISEL: It has a blade with a bevelled back, as shown in figure due to which it can enter sharp corners for finishing, as in dovetail joints.



MORTISE CHISEL: It is used for cutting mortises and chipping inside holes, etc. The cross-section of the mortise chisel is proportioned to withstand heavy blows during mortising. Further, the cross-section is made stronger near the shank.



DRILLING AND BORING TOOLS

CARPENTER'S 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.



AUGER: It is the most common tool used for making holes in wood. During drilling, the lead screw of the bit guides into the wood.



HAND DRILL: Carpenter's brace is used to make relatively large size holes; whereas hand drill is used for drilling small holes.



Drill machine for drilling wood



STRIKING TOOLS

MALLET: It is used to drive the chisel, when considerable force is to be applied, which may be the case in making deep rough cuts. Steel hammer should not be used for the purpose, as it may damage the chisel handle.

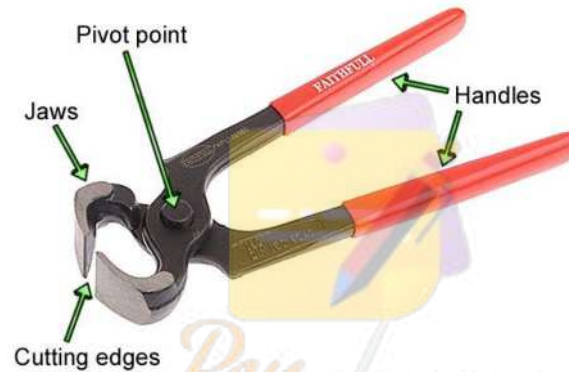


CLAW HAMMER: It has a striking flat face at one end and the claw at the other face is used to drive nails from wood and for other striking purposes.



MISCELLANEOUS TOOLS

PINCER: It is made of two forged steel arms with a hinged joint and is used for pulling-out small nails from wood.



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.



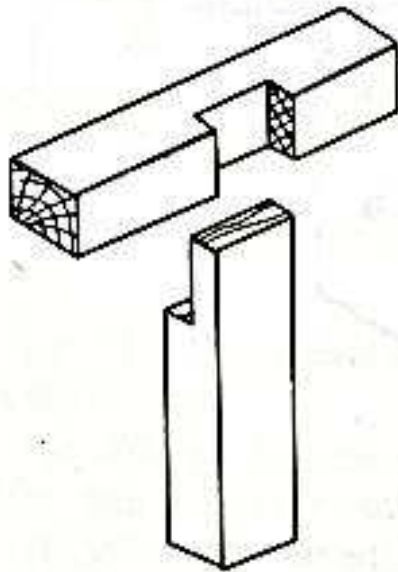
WOOD RASP FILE: It is a finishing tool used to make the wood surface smooth, remove sharp edges, and finish fillets and other interior surfaces.



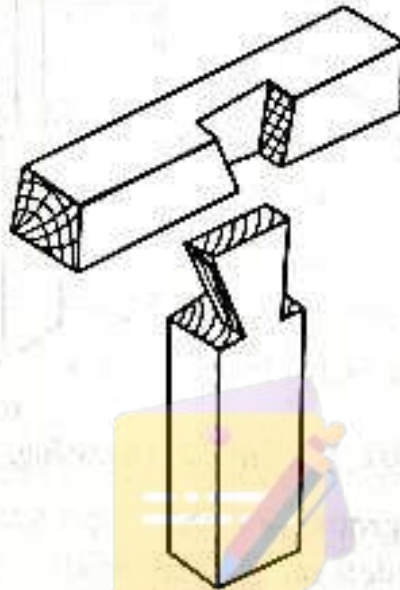
WOOD JOINTS: There are many kinds of joints used to connect wood stock. Each joint has a definite use. The strength of the joint depends upon the amount of contact area.

1. Lap Joint
2. Mitre Joint
3. Butt Joint
4. Mortise and tenon Joint
5. Groove and tongue Joint
6. Dovetail Joint
7. Briddle Joint
8. Dowel Joint

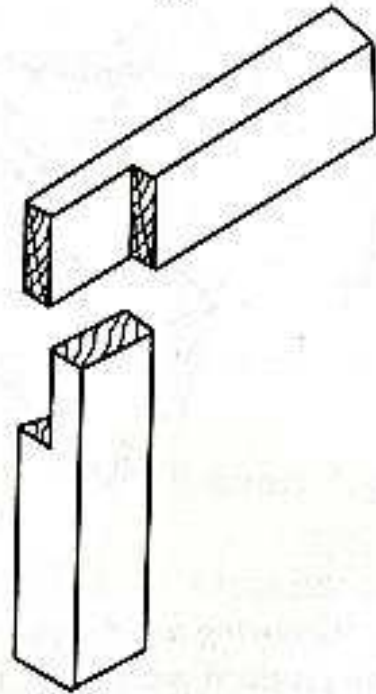




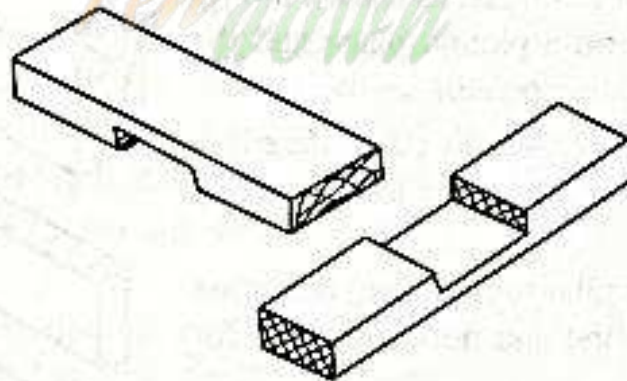
(a) T-lap joint.



(b) Dovetail lap joint.



(c) Corner lap joint.



(d) Cross lap joint.

Types of Lap Joint

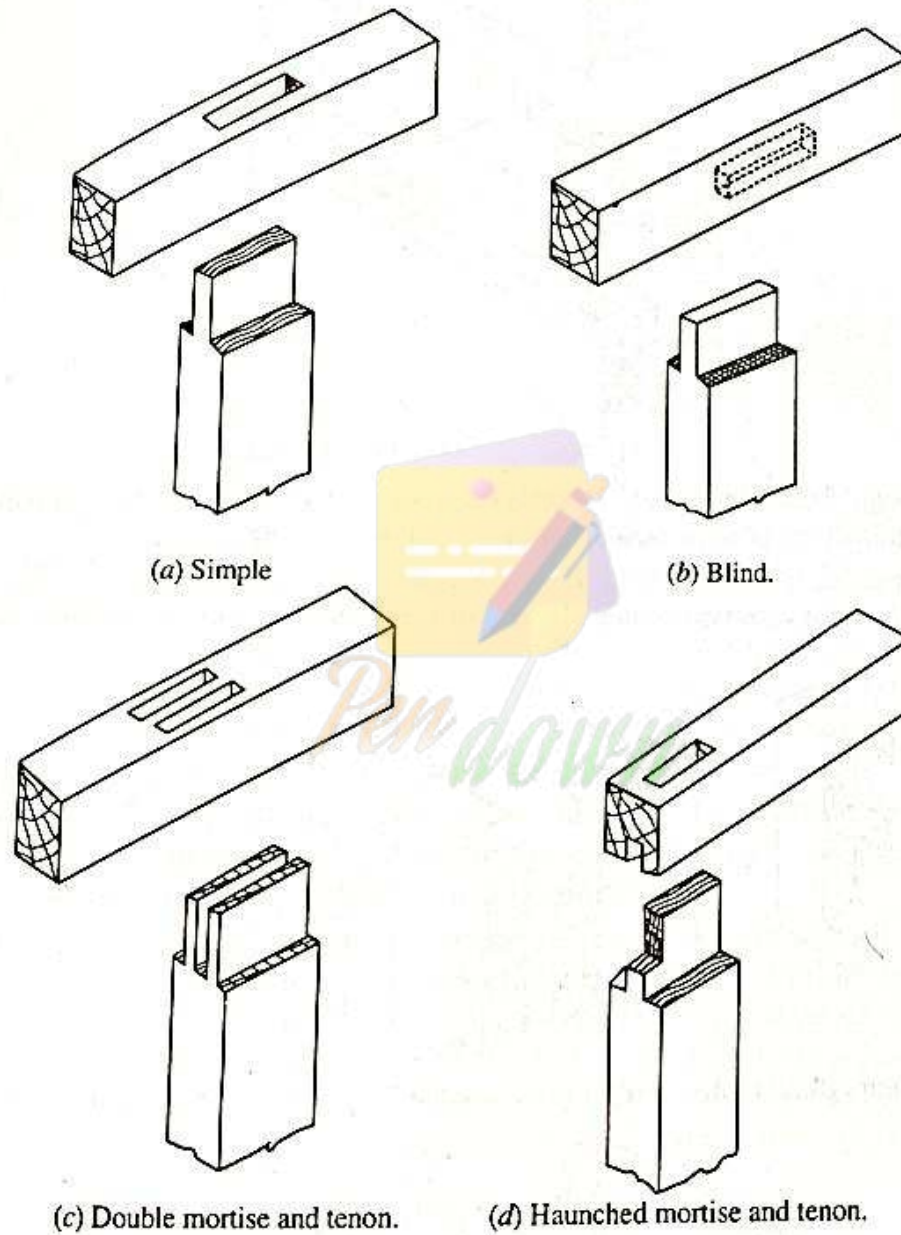
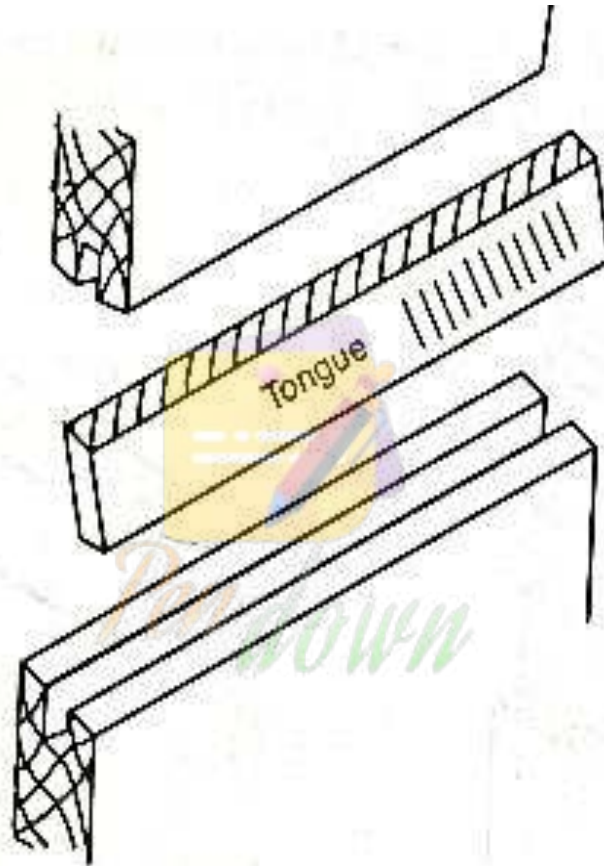
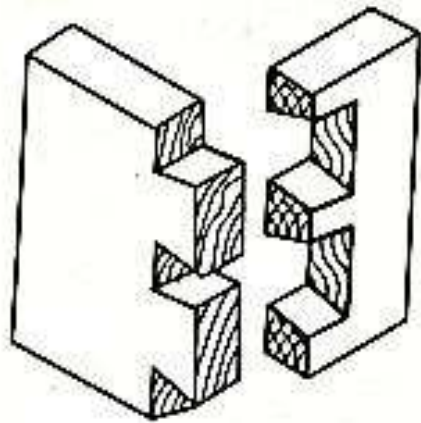


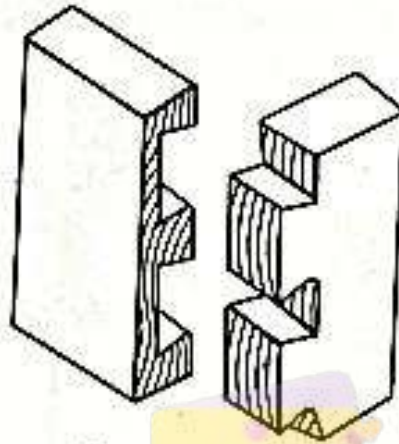
Fig. 9.65. Types of mortise and tenon joints.



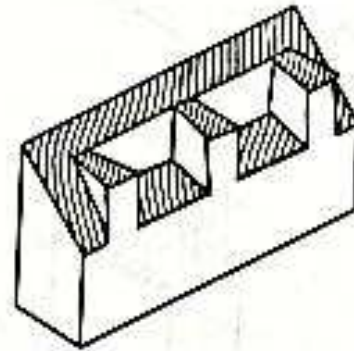
Groove and tongue Joint



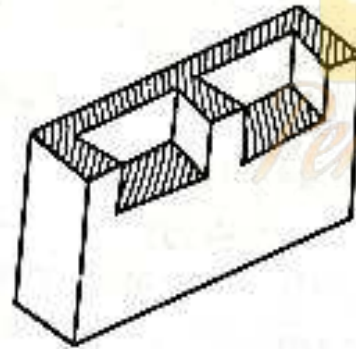
(a) Common or through dovetail.



(b) Lapped dovetail.

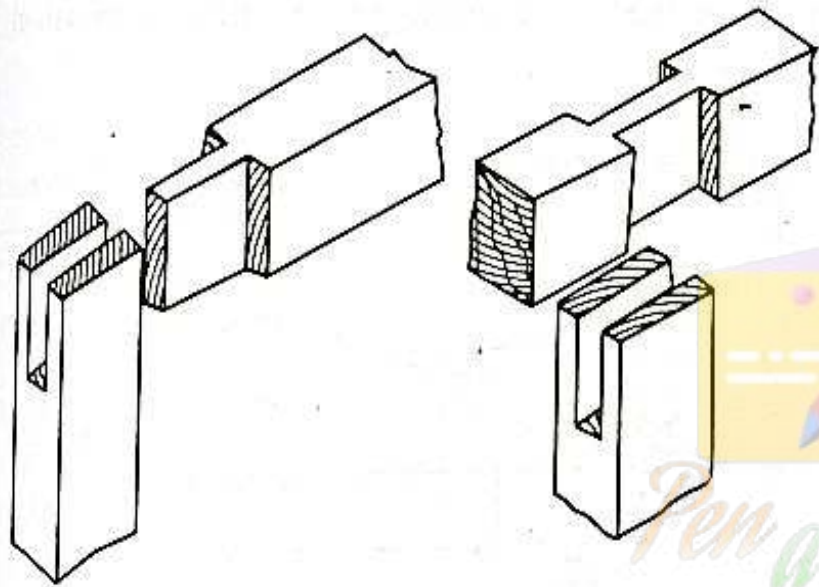


(c) Lapped secret dovetail.



(d) Secret dovetail.

Types of Dovetail Joints



(a) Corner bridle joint.

(b) T-bridle joint.

Fig. 9.68. Types of bridle joints.

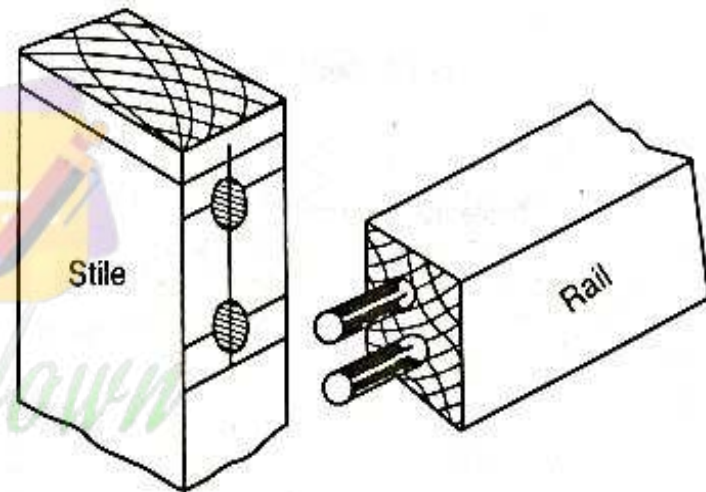


Fig. 9.69. Dowel joint.

WOOD WORKING LATHE



BAND SAW



[Band Saw J-540 E, Aara Machine - YouTube](#)



ELECTRIC WOOD GRINDER



ELECTRIC WOOD PLANER

