Work Shop Practices (ME110)
L-T-P (0-0-3)

Session -1 (December, 2020)

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Presentation Layout

- **Course structure**
- **Introduction of Carpentry**
- **Classification of tools and its uses**
- **Various operations/processes**
- **Reference books and further reading materials**

ME110 Workshop I (0-0-3-3)

1. Familiarization with workshop practice, safety, health and environmental issues, demonstrations in machine, carpentry, fitting, welding and foundry shops.

2. Introduction to different welding processes, demonstration of gas, TIG, MAG and submerged arc welding processes, simple exercises in shielded metal arc welding.

3. Introduction to wood working, hand tools and machines, simple exercises in wood working including making of a simple pattern for foundry.

4. Introduction to foundry shop, exercises in green sand molding and CO2 molding, demonstration of shell molding; familiarization with melting and pouring practices.

5. Introduction to bench work and fitting, simple exercises involving filing, sawing, drilling and tapping.

6. Assembly of the models of CNC machines and exposure to part programming.

7. Practice on working with sheet-metal/ plastic/ glass/ composite.

Texts:

[1] Department of Mechanical Engineering, IIT Guwahati, Workshop Practice Manual, Vidya Mandir, Guwahati, 2018.

References:

[1] S. K. H. Choudhury, A. K. H. Choudhury and N. Roy, Elements of Workshop Technology, Volume I: Manufacturing Processes, Media Promotors, 2008.

[2] H. Gerling, All About Machine Tools, 2nd Edition, New Age International, 2006.

[3] W. A. J. Chapman, Workshop Technology, 4th Edition, Viva Books, 1998.

[4] HMT, Mechatronics, McGraw Hill Education, New Delhi, 2017.

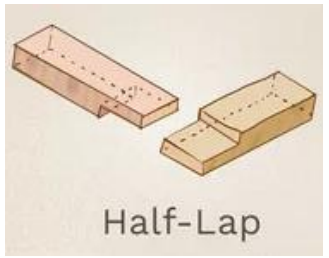
What will you learn in this section?

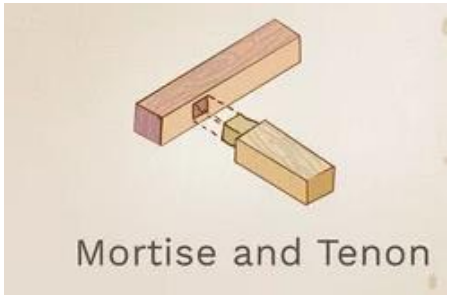
- **Information about various tools**
- **Importance of holding devices**
- **Names of various carpentry joints and applications**
- **Different processes.**

Carpentry

- Carpentry involves the processing of wood to obtain desired shapes and sizes. The person who does this work is knows as Carpenter. The basic information about the tools and operations are discussed in lab.

- Carpentry involves cutting, shaping and joining wood and other materials together to produce a finished product.
- Making of joints is the essential operation in wood work.
- The wooden joints such as lap joints, mortise and T- joints are prepared by the students
- Examples: Door, tables, chairs and other wooden products.
- windows, cupboards, dressers stairs and all interior fitments for a building





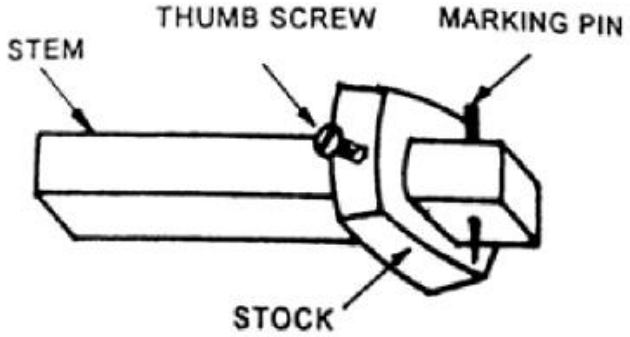
Carpentry Tools Carpentry tools

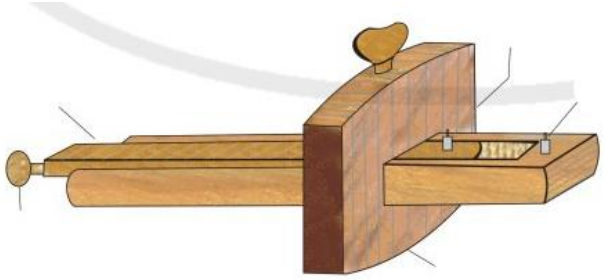
Carpentry Tools Carpentry tools are used to produce components to an exact size. The types of carpentry tools are as follows.

1. Marking tools
2. Measuring tools
3. Holding tools
4. Cutting tools
5. Planning tools
6. Boring tools
7. Striking tools
8. Miscellaneous tools

Marking tools

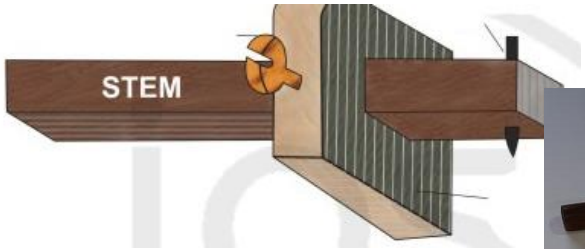
It is used to marking lines on the edges of a wooden piece. It consists of a square wooden stem with a sliding wooden stock on it. On the stem, a marking pin is attached which is made up of steel. This stem is provided with a steel nail to scratch the surface of the work. Mortise gauge consists of two pins; the distance between the pins is adjustable. It is used to draw parallel lines on the stock.





Mortise Gauge

Marking Knife



Marking Gauge

Measuring tools

The carpentry measuring tools are classified as follows

1. Steel tape 2. Steel rule 3. Caliper

- **Steel tapes and steel rules are mainly used for measuring short and lengths in millimeters.**
- **A try square is used for testing squareness and marking of joints.**
- **A meter square is used for marking and measuring an angle of 45 degree.**
- **A bevel square is used for marking and listing angles between 0 degree to 180 degree.**
- **Calipers are used for the precision measurement of cylindrical surface. Inside calipers are used for measuring outside diameter and outside calipers are used to measure inner diameter of a pipe**

Try Square

Bevel Gauge

Outside diameter measuring gauge

Inner diameter measuring gauge

Four Fold Scale

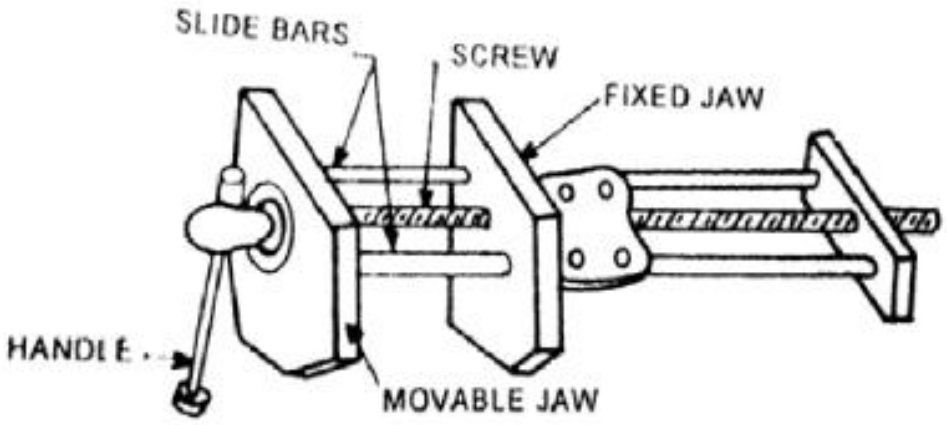
Steel Rule

Vernier caliper

Holding tools

These tools are used to hold the work piece and performing operations.

- Carpentry vice: It is a common work holding device. It has two jaws out of which one is fixed jaw and other is movable. Its one jaw is fixed to the side of the table while the other is movable by means of a screw and a handle.
- Bar clamp: The bar clamp (or) sash cramps are generally used in pairs in gluing up operations at the final assembly of joinery work. It is made up of a steel bar of T-section, wine malleable iron fittings and a steel screw.
- G-clamp G-clamp is made up of malleable iron with acme threads of high quality steel . It can be used for clamping small work when gluing up.



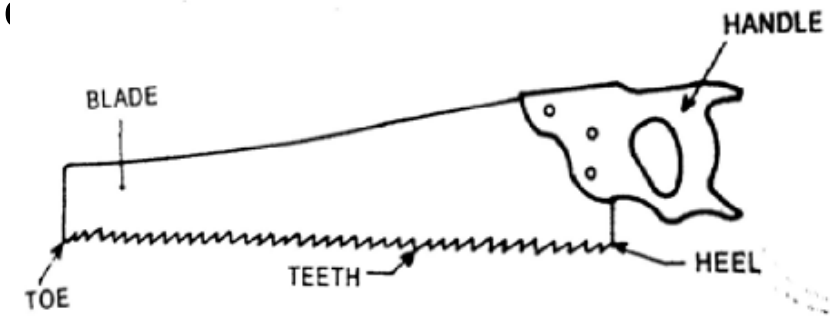
G clamp

Bench Vice

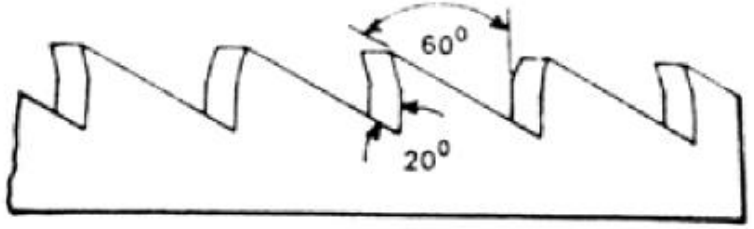
Cutting tools

These tools are used to cut the work piece and performing various operations.

Saws: It is most commonly used cutting tool in carpentry section. It consists of two main parts - the blade which carries the cutting teeth and the handle used for holding during the cutting operations to apply pressure. The classification of saws is according to their teeth and the direction of grains of the wood to be



Rip Saw: It is used to cut wood along the grains. The blade of rip saw is either straight or skew-backed. The teeth are so set that the cutting edge of this saw makes a steeper angle about 60 .



Rip Saw

Cross Cut saw: This is similar in shape of a rip saw. It is used to cut across the grain of the stock. The correct angle for cross cutting is 45 .The teeth are so set that the saw kerf is wider than the blade thickness. This allows the blade to move freely in the cut without sticking.

Tenon or back saw: A tenon saw is used for fine and accurate work. It consists of a very fine blade, which is reinforced with a rigid steel back. The teeth are shaped like those of cross cut saw.

Dovetail Saw : It is a smaller version of tenon saw, this saw is used where the greatest accuracy is needed and fine shallow cuts are to be needed.

Bow-Saw : It has a narrow blade which is held in tension by twisting the string with a small wooden lever. These saws are used for cutting quick curves

Key Hole Saw : It is smallest saw. It has a tapered blade fixed into the handle by screws. It is used for cutting key holes and is very useful for internal and intricate work.

Tenon Saw

Panel Saw

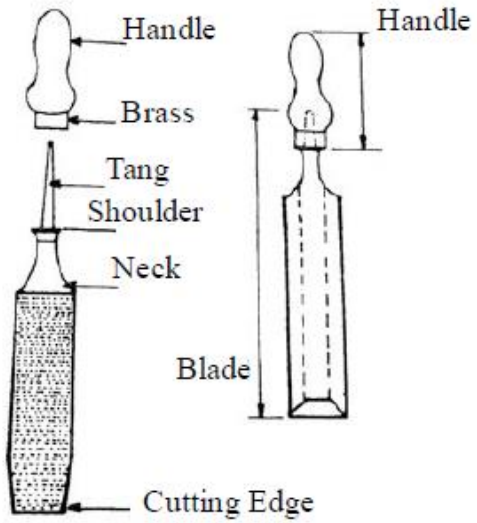
Key Hole Saw

Campus Saw

Cutting tools

Chisels Chisels are used for cutting and shaping wood accurately. Wood chisels are made in various blade widths, ranging from 3 to 50mm .Most of the wood chisels are made into tang type, having a steel shank which fits inside the handle.

- **Firmer Chisel : This chisel is capable of doing heavy work and is used for joining and shaping the wood with or without mallet. The blade is made of rectangular section with bevel edge.**
- **Paring Chisel : These chisel have a long blades used to cut the deep corners with hand pressure. These are mostly used for pattern making.**
- **Mortise Chisel : It is used for taking heavy and deep cuts resulting in more stock removal as in case of making mortises.**
- **Socket Chisel : It is provided with socket instead of tang. The wooden handle is inserted into this socket. This prevents splitting of handle while removing heavy stock**



Mortise chisel

Firmer chisel

Bevel chisel

Half circle chisel

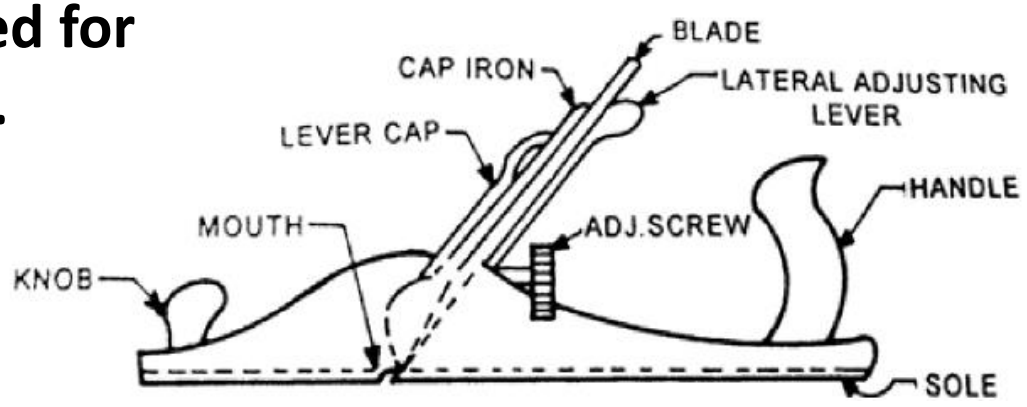
Cutting tools

Planes: These are used for preparing flat and smooth surfaces by removing thin layers of wood. It consists the following parts Body, cutting blade, handle knob and other controls.

Jack Plane (wooden jack pane and iron jack plane): It consists of a wooden body or stock in which blade or cutter is fastened at an angle 45 degree to the sole. The plane iron and cap iron are assembled and inserted in a mouth of plane along with wedge. Back iron supports cutting edge and breaks the shaving so that curls away from the blade.

There are some other type plane which are used for further smoothening or deepening the surface.

Trying Plane
Smoothing plane.
Rebate plane
Plough Plane
Router Plane



Iron Jack plane

Iron Jack Planer

Smooth Planer

Block Planer

Different types of Planer

Boring tools

Boring tools are used for making holes in wood. Various type of Boring tools are used as follows:

Bradwal: It is used for boring small holes for inserting the screws and nails. It has nails. It has chisel like point and it operated by hand.

Gimlet: It is hand operated tool used for making small holes for screws.

Brace: It is a boring tool used for making holes. It holds and rotates various types of bits for producing holes and is operated by hand. The most commonly used braces are ratchet brace and wheel brace. These are used for making larger holes of different sizes.

Auger bit: It is used for producing long deep holes of diameter ranging from 6 to 40 m. It is steel bar , an eye at top to which the handle is fitted. The bottom end is provided with a screw point.

Auger Bit

Striking tools

Striking tools are called hammers used to drive in nails and to operate chisels. The most common striking tools used in carpentry are hammers and mallets.:

Warrington hammer : It is used for bench work and light work. It is made of cast steel with tempered face and peen. The wooden handle fits in the eye and steel widge is driven in to form a rigid joint.

Claw Hammer: It is dual purpose hammer and face is used to drive in nails, and claw at the other end for pulling out nails.

Mallet : It is used for operating the chisel and gauges. it is made of hard wood and is provided with handle.

Wooden Hammer

Plastic Hammer

Rubber Hammer

Other Miscellaneous Tools

(1) Rasp or File : It is used for finishing the wood surface. It has sharp cutting teeth and it is used for finishing small curved surfaces.

(2) Scraper : It has a fine edge which cuts fine shavings and removes plane marks.

(3) Glass paper : Where a surface is having very small imperfections that the no other cutting tool will do, then glass paper is used. It consists of small particles of glass struck tosheet of paper. Its sharp edges cuts the wood.

(4) Ratchet Screw Driver : It is very useful for turning screws through a few degrees

Flat file

Round file

Triangular file

Operation in Carpentry

1. Marking : It is one of the most important operation of wood work and the success of completing a job depends on accurate and orderly marking. These dimensions can be measured from an existing model and can be set out from the drawing prepared for the purpose. The dimensions are marked with respect to the finished edge or finished face of a work.

2. Sawing : Sawing is one of the basic cutting operation carried out in a carpentry shop. To start the cut, the thumb of left hand is placed against the blade. This steadies the blade and enabling it to start in the right place. One or two short movements are given first, taking care that the saw works in the right direction. And then full, easy strokes are applied to cut the wood in a forward direction only. A point to note in all sawing work that the cut is made on one side of the line already marked and that is on waste side

3. Planing : It is the operation of tuning up a piece of wood by a planner. The work for planning is supported by the bench stop in the vice. The pressure is applied during forward stroke and released on the returned stroke. It is important to move plane in straight line to avoid rounding at the ends and to obtain smooth surface. Planing is done along the grains. The surface planed are tested for flatness in all directions using a try square.

4. Chiselling : It is the process of cutting excess wood with chisel to obtain desired shape. In chiseling hard pressure is applied to remove thin layers. Mallet is used when cuts are made across the grains

5. Boring : It is the process of making holes in wood. The work is secured to suitable vice and the hole position is marked with punch. The hole is provided by turning and feeding the bit into work.

6. Rebating : It is the process of cutting a recess along the edge of wood by a rebate plane. While rebating, the plane must be kept pressed into the side of the wood.

7. Polishing : It is the process of producing a smooth reflecting surface with only the minimum removal of material. To obtain such a finish it is necessary to incorporate a suitable abrasive within the polishing composition.

Carpentry Joints

Terms joinery involves connecting of different wooden parts together by means of properly made joints. In order to achieve good results, the joint made in wood work are usually secured firmly by means of suitable fastners such as glues, dwels, screws, bolts and buts etc.

1. Halving Joint : The purpose of this joint is to reuse the corners and inter sections of the framing and at the same time keep all the face flush that in the same plane. These joints are used in construction of frames. Marking and cutting of any joint must be accurate, so that it can shed together with the final extreme surface level.

2. Mortise and Tenon Joint : It is strongest joint and is used for the construction of doors windows and frames. The tenon (tongue) fits into a mortise (mouth).

3. Mitre Joint : It is formed by cutting the ends at an angle. The two ends are joined by nails or screws. This joint is used in photo frames.

4. Dovetail Joint :This is strongest joint used for construction of boxes and cup boards.

5. Butt Joint : The fastening of boards edges to edges is frequently necessary to give a wider board. eg. Drawing board. In butt joint two true edges are joined with glue. If it is properly done this joint is very strong.

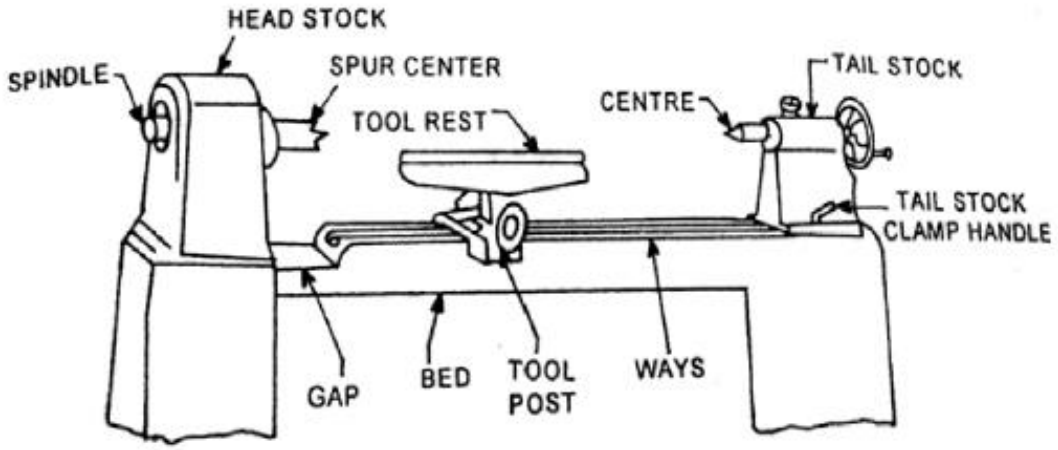
Double cross-half lap joint

T-joint

Wood Working Machines

- Wood working machine plays a vital role in the modern wood work particularly where large scale production of wooden articles is carried out.
- Modern development in wood working machinery with regard to the greater safety for the operator, easy operation and greater accuracy. These developments led to higher output

Wood Turning Lathe : It is one of the important and oldest machine used in carpentry shop. This is employed primarily for turning jobs in making cylindrical parts. It resembles the engine lathe most frequently used in the machine shop and consists of a cast iron bed, head stock, tail stock, tool rest, live and dead centres and speed control device.



Wood Planner : It is used for planning large work pieces and capable of producing true surface with enough accuracy at a faster rate. It consist of table over which the work is fed against a revolving cylindrical cutter head carrying 2-3 knifes. The cutter is mounted on a over head raft and the table can raised or lowered to attain desired thickness

Thank you