**BASIC TECHNOLOGY JSS 2**

**SECOND TERM**

# **SCHEME OF WORK**

|  |  |
| --- | --- |
| **WEEK** | **TOPIC** |
| 1 | REVISION/CIRCLES |
| 2 | QUADRILATERALS |
| 3 | POLYGONS |
| 4&5 | AREA OF PLANE FIGURES |
| 6&7 | WOODWORK MACHINES |
| 8&9 | METALWORK MACHINES |
| 10 | FRICTION |
| 11 | REVISION |
| 12 | EXAMINATION |

**REFERENCE MATERIALS**

1. MELROSE, Basic Science and Technology, Book 2
2. NERDC, Basic Technology for JSS, Book 2

**WEEK ONE CLASS: \_\_\_\_\_\_\_\_\_\_\_\_\_\_**

TOPIC: REVISION/CIRCLES

**CONTENT**

* DEFINITION OF CIRCLE

PARTS OF A CIRCLE

A circle is a plane figure bounded by a curved line called the circumference. All the points on the circumference of a circle are equidistant from a point called the centre.

**parts of a circle**

1. **Diameter**

The diameter is a straight line drawn through the centre of a circle and meeting the circumference at both ends.

1. **Radius**

The radius is a straight line drawn from the centre of a circle to any point on the circumference of the circle. The length of the radius is always used to draw the circle.

1. **Segment**

The segment is an area of the circle bounded by an arc and a straight line called the chord.

1. **Chord**

The chord is a straight line which joins any two given points on the circumference of a circle.

1. **Sector**

The sector is part of the circle bounded by two radii and an arc.

1. **Quadrant**

The quadrant is the part of the circle bounded by two radii which are at right angles to each other, bounded by an arc. The quadrant, as the name, is ¼ of the circle.

1. **Tangent**

The tangent is usually formed outside the circle. When a straight line touched is formed. However, that line must be right angle to a radius.

**EVALUATION**

1. Draw a circle 30mm and show the different parts.
2. Explain each part of a circle

**How to draw a circle given the radius**

**Procedure**

* Draw the centre lines horizontal and the other vertical, to intersect each other at E at 900.
* The point of intersection is the centre. With the compass at centre E, pick the given radius into the compasses.
* The point of intersection E, is the centre of the circle. Place the pinpoint of the compasses on the centre and swing the pencil round such that the pencil makes 3600 to give the circle.

**How to construct a circle through a three points which are not on a straight line.**

**Procedure**

* Join the given points ABC with straight lines AB and BC.
* Draw the perpendicular bisector of the two lines AB and BC to intersect at point D.
* The point of intersection D is the centre of the circle. With point D as centre, set the pencil point of the compasses to any of the three given point A, B or C
* Swing your compass through the three points to produce the circle.

**How to construct a series of circles touching one another on the two converging lines**

**Procedure**

* Copy the given converging lines AB and AC.
* Bisect the angle between the converging lines BA and CA.
* Draw a line from A to pass through D.
* AE is the bisector, and the centre of the circles is located on the bisector.
* Draw the largest circle by placing the point of the compasses somewhere on the bisector and adjust the pencil point, until the required radius is obtained.
* Draw a tangent FG to the circle at point of intersection between the circumference of the circle and the bisector .
* Bisect the angle IJA
* Draw a line through point K to intersect main bisector AE at L.
* Note that point L is the centre for smaller circle.
* With centre L draw the smaller circle to touch the bigger circle tangentially.

**How to find centre of a circle**

**Procedure**

1. Draw the given circle.
2. Draw any two chords AB and AC.
3. Bisect lines AB and AC. The bisecting lines will intersect at O.
4. O is the centre of the circle.

**EVALUATION**

1. Draw a circle of diameter 80 mm and determine its centre.
2. Draw three circles of diameter 40mm touching each other

**REFRENCE BOOK**

* MELROSE, Basic Science and Technology, book 2 page 81-83.
* NERDC, Basic technology for JSS book 2, page 52-56.

**WEEKEND ASSIGNMENT**

1. The part of the circle that is bounded by an arc and a chord is A. segment

B. sector C. diameter D. tangent.

1. A straight line drawn through the centre, meeting the circumference at both ends is called A. sector B. radius C. diameter D. tangent
2. A plane figure bounded by a curved line called circumference is called-------

A. triangle B. circle C. quadrilaterals D. curved line

1. Any straight line drawn across the circle, meeting the circumference at both ends is called A. chord B. tangent C. radius) D. diameter
2. Which of the following can be used to draw a circle? A. protractor B. French curve C. compass D. template

**THEORY**

1. Draw a circle of radius 35mm and divide it into 12 equal sizes.
2. Draw a circle and with shaded portion show (i) quadrant (ii) sector (iii) segment inside the circle

**WEEK TWO**

**TOPIC: QUADRILATERALS**

**CONTENT**

* Types of Quadrilaterals
* Construction of a rectangle given its diagonal and one side
* Construction of a rhombus given its side and a diagonal

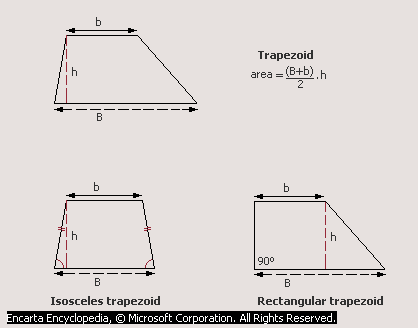
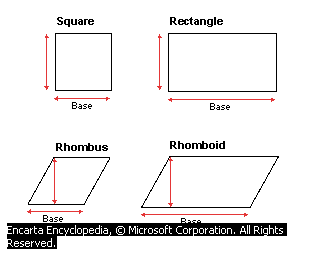
1. Construction of a rhomboid given its diagonal and one side.

QUADRILATERALS

Quadrilaterals are plane figures bounded by four straight lines. The sum of angles in a quadrilateral is 3600.

# A straight line called the diagonal may join any two opposite angular points.

# Types of quadrilateral

* 1. Parallelogram: This is a quadrilateral with it’s opposite sides equal and parallel.
  2. Square: A square is a parallelogram, which has its entire sides equal and each angle a right angle.
  3. Rhombus: A rhombus is a parallelogram, which has its sides equal but no angle is a right angle.
  4. Rectangle: A rectangle is a parallelogram, which has each angle a right angle.
  5. Rhomboid: A rhomboid is a parallelogram, but no angle is right angled.

EVALUATION

1. What is a quadrilateral?

3. State the types of quadrilateral

### CONSTRUCTION OF QUADRILATERALS

**Construction of Squares**

**A. To construct a square upon a given side.**

#### Procedure

(i) Draw a line and mark off AB equal to the side of the square.

(ii) At A, erect a perpendicular AC marking AC equal to AB.

(iii) With center C and a radius equal to AB, strike an arc with center B and the same radius; strike another arc to intersect the previous one at D.

(iv) Joint CD and BD to obtain the required square ABCD

**B.** **TO CONSTRUCT A SQUARE GIVEN THE LENGTH OF ITS DIAGONAL.**

***Procedure***

(i) Draw a horizontal line and a vertical line, which intersect at O.

(ii) With center O and a radius equal to half the length of the given diagonal, cut the horizontal line at A and B, and the vertical line at C and D.

(iii) Join AD, DB, BC and CA to obtain the required square ADBC.

#### Construction of Rectangles

***A. To construct a rectangle given its length and breadth***

#### Procedure

(i) Draw a line and mark off AB equal to the length of the rectangle.

(ii) At A, erect a perpendicular AC making AC equal to the breadth of the rectangle.

(iii) With center C and a radius equal to AB, strike an arc. With center B and a radius equal to AC, strike another arc to intersect the previous one at D.

(iv) Join CD and BD to obtain the required rectangle ABDC

**B. To construct a rectangle given its diagonal and one side.**

***Procedure***

(i) Draw a line and mark off AB equal to the given diagonal.

(ii) Bisect AB at C, and with center C draw a circle with AB as diameter.

(iii) With center A and a radius equal to the given side of the rectangle, cut the circle on any side of AB at D. with center B and the same radius, cut the circle on the other side of AB at E.

(iv) Join AE, EB, BD and DA to obtain the required rectangle AEBD.

**Construction of a Parallelogram**

**To construct a parallelogram given the length of the two sides and one angle**

* 1. Draw one side AB, say 10cm
  2. Construct the given angle AB1, i.e 120o
  3. With center B and radius BC, i.e., 4cm, draw an arc to cut B1 at C
  4. With center A and radius BC, draw an arc
  5. With center C and radius AB, draw an arc to cut the previous arc at D.
  6. Join AD and DC

**Construction of a Trapezium**

**To construct a trapezium given the parallel, the perpendicular distance between them and one angle**

1. Draw one of the parallels AB=8cm
2. Construct the given angle BA1=50o
3. Draw the parallel CD, i.e., 4.5cm
4. Join D to B to complete the trapezium

**Construction of Rhombus**

**A. To construct a rhombus given its side and a diagonal.**

**Procedure**

(i) Draw a line and mark off AB equal to the given diagonal.

(ii) With center A and a radius equal to the side, strike arcs above and below AB.

(iii) With center B and the same radius, cut the previous arcs at C and D.

(iv) Join AD, DB, BC and CA to obtain the required rhombus ADBC.

**B. To construct a rhomboid given a diagonal and two sides.**

**Procedure**

(i) Draw AB equal to the given diagonal.

(ii) With centers A and B and a radius equal to one of the sides, strike arcs above and below AB respectively.

(iii) With center B and a radius equal to the other side, strike arcs to intersect the previous ones at C and D respectively.

(v) Join AD, DB, BC and CA to obtain the required rhomboid ADBC.

EVALUATION

1. Construct a parallelogram in which length of two sides equal 10cm and one of the angle is 120o
2. Construct a square given the length of its diagonal to be 5cm

**WEEKEND ASSIGNMENT**

1. A plane figure bounded by four equal sides is called \_\_\_\_\_\_ A. square B. rectangle C. trapezium D. kite
2. Opposite sides of a parallelogram are \_\_\_\_\_\_\_ A. diagonal B. parallel C. vertex

D. straight

1. The diagonals in a rhombus bisect each other at A. 900 B. 600 C. 450 D. 700
2. A quadrilateral with only two parallel sides is called \_\_\_\_ A. square B. rectangle C. trapezium D. kite
3. The diagonals in a trapezium bisect each other to give A. 900 B. equal opposite angles C. parallel opposite angles D. 450

**THEORY**

1. Construct (i) a square and (ii) rectangle with diagonal of 120mm
2. (i) Define Quadrilateral (ii) Construct a rectangle ABCD, AB=40mm BC=70mm

**WEEK THREE**

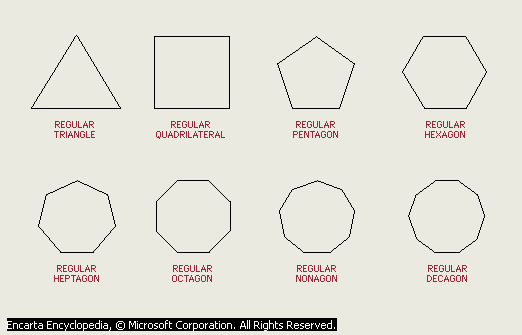
**TOPIC: POLYGONS**

**CONTENT**

* Definition
* Types of polygon
* Construction of different polygons

What is a polygon?

A polygon is a plane figure with five or more straight sides. A polygon can either be regular or irregular A polygon is said to be regular it all its sides are equal and its angles are equal. An irregular polygon has unequal sides.



**Types of polygons**

1. Pentagon: A pentagon is a polygon with five sides.

2. Hexagon: A hexagon is a polygon with six sides

3. Heptagon: A heptagon is a polygon with seven sides.

4. Octagon: An octagon is a polygon with eight sides.

5. Nonagon: A nonagon is a polygon with nine sides.

6. Decagon: A decagon is a polygon with ten sides.

**EVALUATION**

1. What is a polygon?

2. Explain different types of polygon.

**CONSTRUCTION OF POLYGONS**

**Construction of a regular Hexagon given its side.**

**A. Using 60o set - square**

**Procedure**

(i) Draw a horizontal line and mark off AB equal to the side of the hexagon.

(ii) Through A, draw a line at 60o and mark off AC equal to AB

(iii) Through B, draw a line at 60o and mark off BD equal to AB.

(iv) Through C, draw a line at 60o parallel to BD and mark off CE equal to AB.

(v) Through D, draw a line at 60o parallel to AC and mark off DF equal to AB.

(vi) Join EF to complete the hexagon.

**B. Using compasses: - This method is called constant radius rule.**

**Procedure**

* 1. Draw a circle whose radius is equal to the side of the hexagon. Draw the horizontal diameter AB.
  2. With center A and the same radius, cut the circle above AB at C and below AB at D
  3. With center B and the same radius, cut the circle above AB at E and below AB at F.
  4. Join AD, DF, FB, BE, EC and CA to obtain the hexagon.

**Constructing a regular hexagon given the distance across flats.**

Procedure

(i) Draw a circle whose diameter is equal to the distance across flats. Draw the vertical diameter AB.

(ii) Draw diameter CD and EF at 30o.

(iii) Through A and B, draw horizontal tangents.

(iv) Through C, D, E, F, in turn, draw tangents at 60o. The figure that is formed by the intersection of the tangents is the required hexagon.

This is the procedure when describing a regular hexagon about a given circle.

#### To construct a regular Octagon given its sides

Procedure

(i) Draw a horizontal line mark off AB equal to the given side.

(ii) Through A and B, draw lines at 45o and mark off AC and BD equal to AB.

(iii) Through C and D, draw vertical lines and mark off CE and DF equal to AB.

(iv) Through E and F, draw lines at 45o and mark off EG and FH equal to AB.

(v) Join GH to complete the octagon.

**To construct a rectangular octagon given the distance across flats.**

**Procedure**

(i) Draw a circle whose diameter is equal to the distance across flats. Draw a horizontal diameter AB and a vertical diameter CD.

(ii) Draw diameters EF and GH at 45o

(iii) Draw vertical tangents through A and B and horizontal tangents through C and D.

(iv) Through E, F, G, H, in turn draw tangents at 45o. the figure formed by the intersection of the tangents is the required octagon.

This is the procedure when describing a regular octagon about a given circle.

**General methods for constructing a regular polygon on a given base.**

**A.** The External Rule – 360o

N

**Procedure**

(i) Obtain the external angle of the required polygon by dividing 360o by the number of side (N) of the polygon, i.e. external angle = 360o/N

(ii) Draw a horizontal line and mark off AB equal to the given base.

(iii) Through A, draw a line at 360o/N and mark off a length equal to AB. Also at B, draw a line at 360o/ N and mark off a length equal to AB.

(iv) Continue the process until you have obtained the polygon of N sides where N = 5, 6, 7, 8, 9, 10…… Suppose that at N = 5, then external angle = 360o/5= 72o

**B. THE TWO–TRIANGLE RULE.**

**Procedure**

(i) Draw a horizontal line and mark off AB equal to the given base.

(ii) Bisect AB and produce its bisector as long as it is convenient.

(iii) On AB as base, draw an isosceles triangle with base angle 45o and an equilateral triangle so that the apexes of the two triangles lie on the bisector of AB. Denote the apex of the isosceles triangle as F.

(iv) Bisect FD to obtain point e.

(v) Along the bisector of AB, from point f, step off length de (or if) to obtain points G, H, L, J, e.t.c. The points D, E, F, G, H, L, J, are the centers of the circumscribing circles for a square, regular pentagon, hexagon and decagon respectively.

(vi) Suppose you want to draw a polygon of 8 sides (octagon).

With center h and radius HA (or HB) draw a circle. Take length AB and step it off on the circle to obtain the points C, D, E, F, G, H, I. Join the points to obtain the required regular nonagon. Note that D = 4; E = 5;F = 6;G = 7;H = 8;L = 9;J = 10.

Conclusion

A polygon may be regular or irregular. When it is regular, all its sides are equal, and its angles are also equal. Polygons include pentagons, hexagons, heptagons, octagons, nonagons, and decagons, which have five, six, seven, eight, nine, and ten sides respectively.

Evaluation

1. Construct a hexagon using the 600 by 300 set-square
2. State the formula for generally constructing a polygon

WEEKEND ASSIGNMENT

* 1. Which of the following is not a polygon? A. Circle B. Triangle C. Decagon

D. Heptagon.

* 1. Two angular points are joined by a \_\_\_\_\_\_\_ A. diagonal B. vertex C. horizon

D. pinnacle

* 1. A polygon is a plane figure with \_\_\_\_\_or more straight sides. A. Five B. three

C. four D. two

* 1. A regular polygon has \_\_\_\_\_\_\_\_\_\_ of its sides and angles equal A. five B. all C. three D. four
  2. An Octagon is a polygon with \_\_\_\_\_\_\_\_\_ sides A. 5 B. 6 C. 7 D. 8

THEORY

1. A. Define polygon

B. What are regular polygons?

2. Construct (i) a square of side 60mm (ii) a regular hexagon of side 80mm.

**WEEK FOUR AND FIVE**

**TOPIC**: **AREA OF PLANE FIGURE**

**INTTRODUCTION**

Plane figures are flat two-dimensional shapes. The can be made of straight lines, curved lines or both straight and curved lines. Examples of plane figures are: triangle, square, parallelogram, circle, rectangle etc.

**AREA OF PLANE FIGURES**

When a plane figure is drawn, it occupies a certain amount of space. At times, it is important to know the amount of space of a figure occupies, when it is drawn. This way, it will be possible to draw a different shape that has the same amount of space with it.

Therefore, area of a plane figure can be defined as the space it occupies.

**Area of a triangle**

b

**h** h

h

Area = ½ of (b x h) where b=base and h= vertical height

**Note:** The area of any plane figure (polygon) can be reduced to a combination of areas of rectangles (Or squares) and triangles each of which can be computed and the total area together.

**Area of a rectangle**

l

b

Area= l x b where l= length and b= breadth

**Area of a square**

a

a

Area= a x a= a2 where a= length of side

**Area of a parallelogram**

b

h

Area= b x h where b= base and h= vertical height

**Area of a circle**

Area= πr2 where r= radius

**Evaluation**

1. Define the area of plane shape.
2. State the area of (i) triangle (ii) rectangle

**THEOREMS**

In construction regular plane figure of equal areas, some geometrical laws, generally called theorems, are applied. For instance, the following are will be relevant to this topic:

* + 1. **Triangles on the same base and between the same parallels are equal in area.**
    2. **Triangles on equal bases and between the same parallels are equal in area.**

1. **Parallelograms on the same base and between the same parallels are equal in area.**
2. **Parallelograms on equal base and between the same parallel are equal in area.**
3. **A triangle on the same parallels with a parallelogram is half the area of the parallelogram.**
4. **if a triangle and a parallelogram are on equal bases and between the same parallels, the triangle is half the area of the parallelogram**

**Evaluation**

* + 1. State 6 theorems of area of plane shape
    2. Sketch diagrams that demonstrate the theorems of plane shape.

**CONSTRUCTION OF SIMILAR AREA OF PLANE SHAPES**

**Constructing a triangle equal in area to a given rectangle**

**Procedure**

1. Draw the rectangle ABCD
2. Project line CD and mark off DE, using the distance equal to CD.
3. Draw a horizontal line from point F to line BA parallel to BC.
4. Locate point G anywhere on line EF.
5. Join point G to B and C respectively, to obtain the triangle equal in area to rectangle ABCD. Triangle BCG is equal to the given rectangle.

**Constructing a rectangle equal in area to a given triangle**

**Procedure**

1. Draw the given triangle ABC.
2. Draw a line through A, parallel to BC.
3. Bisect line BC perpendicular at D and to meet the line through at D and to meet the line through A at E.
4. Draw a perpendicular to BC at B meet the line through A at F.
5. FBDE is the rectangle required

**Evaluation**

1. Construct a triangle equal in area to a rectangle AB=50mm, BC=60mm.
2. Construct a rectangle equal in area to a triangle ABC, AB= 40mm, AC=70mm and BC=60mm

**Constructing a triangle equal in area to any regular polygon**

**Procedure**

1. Draw the regular polygon (hexagon) ABCDEFG
2. Draw the diagonals to intersect at the centre of the polygon O.
3. Draw HI equal in length to the length of side x number of sides. In this exercise, GH is equal to six times, the length of the side of the hexagon. (HI= 6 x y mm)
4. Join O to G and H, GOH is required triangle

**Constructing a triangle equal in area to a given circle**

**Procedure**

1. Draw the given circle of diameter AB and centre O.
2. Divide the radius OA into 7 equal parts
3. Draw a perpendicular line at A equal in length to 3 1/7
4. Join C to B.ACB is the required triangle

**Reducing an irregular quadrilateral to half its original area**

**Procedure**

1. Draw the given irregular quadrilateral ABCD
2. Draw a diagonal BD
3. Bisect AB perpendicular at E
4. With centre E and radius EA, draw an arc to meet the bisector at F.
5. With centre B and radius BF, draw an arc, which meets the bisector at F.
6. From G and GH parallel to AD, also draw HI parallel to DC.
7. GBIH is required reduced irregular quadrilateral.

**Evaluation**

1. Construct a triangle equal in area to any regular hexagon 50mm.
2. Draw a triangle equal in area to a given circle of radius 40mm.

WEEKEND ASSIGNMENT

1. The space which a plane shape occupies is known as \_\_\_\_\_\_\_ A. triangle

B. rectangle C. parallelogram D. area

1. The units of area are as follows except A. mm2 B. cm2 C. kg2 D. m2
2. Triangles on the same base and between the same parallels are equal in area

A. True B. False C. None of the above D. All of the above

1. A triangle on the same base and between the same parallels with a parallelogram. A. True B. False C. None of the above D. All of the above
2. The area of a triangle is \_\_\_\_A. ½ B x H B. B x H C. B2 x H D. B x H2

**THEORY**

1. State 6 theorems of area of plane shape
2. Construct a right-angled triangle, which has the same area with an equilateral triangle of side 60mm.

**WEEK SIX AND SEVEN**

**TOPIC: WOODWORK MACHINES**

**CONTENT**

* Introduction
* Woodwork Machines
* Circular Sawing Machine
* Surface Planing
* Thicknessing Machine
* Drill Press Machine
* Wood Lathe
* Band Saw

**Introduction:**

Woodworking machines are essential tools used in the wood processing industry to prepare wood for various applications. These machines play a crucial role in heavy woodworking operations and are instrumental in achieving efficient mass production.

In the past, the majority of sawing operations were performed manually, requiring substantial physical effort and time. However, with advancements in technology, modern woodworking has been revolutionized by the introduction of various machines that have significantly improved efficiency and productivity.

**Evaluation**

1. State the reasons for using wood working machines.
2. Mention two manual wood working tools

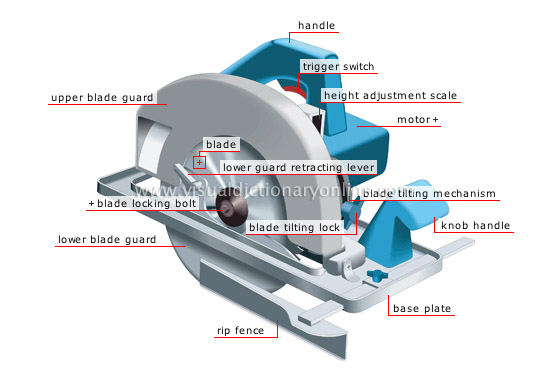
**WOODWORK MACHINES**

Woodwork machines include the following:

1. Circular sawing machine
2. Surface planing
3. Thicknessing machine
4. Drill Press machine
5. Wood lathe
6. Band saw

**Circular Sawing Machine:**

A circular sawing machine is a vital woodworking tool designed for re-sawing and preparing timber into appropriate sizes for various applications such as joinery and furniture production. Circular saws come in different types, including the ripsaw and cross-cut saw. Additionally, specialized saws can be attached to the machine as needed, enhancing its versatility. These include the upper saw, hollow ground saw, ground-off saw, wobble saw (sometimes humorously referred to as a drunken saw), novelty saw, and planer saw.

For tasks that demand similar capabilities to a circular sawing machine but with added flexibility, a hand-feed bench-type saw with a tilting arbor and a rise-and-fall attachment proves to be the most suitable choice. This versatile alternative ensures precise and efficient cutting, making it an indispensable tool in the woodworking industry. 

2. **Band Sawing Machine:**

The band sawing machine is a sophisticated woodworking apparatus equipped with a compensating mechanism that facilitates the movement of the upper pulley, allowing it to adjust vertically. This ingenious design accommodates variations in the saw's configuration while maintaining consistent tension on the blade. This feature ensures precise and continuous cutting, making the band sawing machine an invaluable tool in the realm of woodworking.



**3 Surface Planing Machine:**

The surface planing machine is a pivotal woodworking apparatus designed to meticulously plane sawn timber, effectively eliminating any surface imperfections and ensuring a perfectly flat surface. Planing, a historically labor-intensive woodworking task, has been remarkably transformed with the introduction of planing machines. These machines empower craftsmen to precisely plane wooden pieces to their required thickness, facilitating seamless edge-to-edge joining.

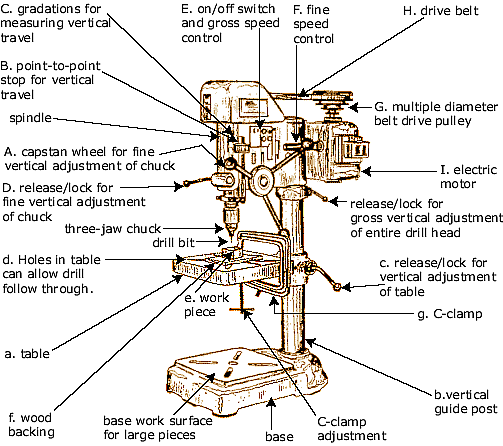
Furthermore, the surface planing machine exhibits its versatility by expertly truing up edges, erasing any unsightly marks, and rectifying any inherent "wind or twist" on the wood's surface. Beyond these core functions, it also excels in handling tasks such as chamfering, beveling, tapering, and tenoning, thus making it an indispensable asset in the **realm of woodworking.** 

1. **Thicknessing Machine:** This is a woodworking machine that is used exclusively for planing wood to a specific thickness after surface planing operation.

In order to achieve a perfect operation, the front table is pulled backwards from the cutter block to allow the wood chips fly out.



1. ***The Drill Press:*** This another wood working machine, which can also be used as machine tools, used for performing various operations such as boring, sanding and mortising.



1. ***Wood Lathe Machine****:* This is a wood working machine, which can be used for metal working operations, employed where a number of turning will be made.

Generally, turning can be made on the lathe in two ways i.e. between centres and the faceplate- both inside and outside. The lathe bed must be sturdy. The headstock runs on double bearing which may be directly driven with about four speeds

**Evaluation**

1. State six woodwork machine
2. Differentiate between surface planing machine and Thicknessing machine
3. Draw and label the drill press.

**WEEKEND ASSIGNMENT**

1. Which of the following is not a wood working machine A. Circular sawing machine B. Surface planing machine C. Milling machine D. Thicknessing
2. A machine that is used to resaw or prepare timber into suitable sizes for articles of joinery and furniture is known as A. Circular sawing machine B. Surface planing machine C. Milling machine D. Thicknessing
3. A machine that is used exclusively for planing wood to a specific thickness after surface planing operation is called \_\_ A. Circular sawing machine B. Surface planing machine C. Milling machine D. Thicknessing
4. A wood working machine, which can also be used as machine tools, used for performing various operations such as boring, sanding and mortising is known as A. Drill press B. Surface planing machine C. Milling machine D. Thicknessing
5. The largest wood working machine is \_\_\_ A. Drill press B. Wood lathe machine

C. Milling machine D. Thicknessing

**THEORY**

1. Explain the functions of six woodwork machines
2. Draw and label drill press.

**WEEK EIGHT AND NINE**

**TOPIC: METALWORK MACHINES**

**CONTENT**

* Definition
* Shaping machine
* Planing machine
* Milling machine
* Grinding machine
* The drill press
* The lathe machine

**Definition**

Metalwork machines are machines used for metal work operations. The various types of metalwork machines include the following:

1. Shaping machine
2. Planing machine
3. Milling machine
4. Grinding machine
5. The drill press
6. The lathe machine

**Evaluation**

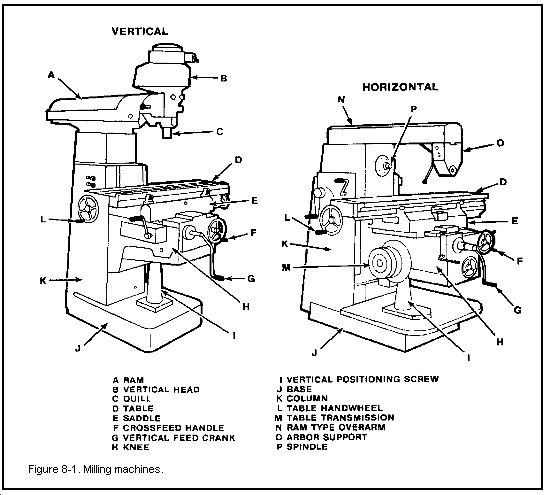
1. Define machine tools
2. State 6 machine tools

**The Milling Machine:**

A milling machine stands as a versatile machine tool employed for precision machining of solid materials. These machines can be categorized into two fundamental types: horizontal and vertical, referring to the orientation of their main spindle. Milling machines come in a range of sizes, from compact bench-mounted models to substantial room-sized installations.

In contrast to a drill press, where the workpiece remains stationary while the drill moves axially to penetrate the material, milling machines exhibit a distinctive feature. They not only rotate the workpiece but also move it radially against the rotating milling cutter, allowing the cutter to engage both the sides and the tip of the material. This dual-axis movement is meticulously controlled, with precision typically reaching less than 0.001 inches (0.025 mm). This control is achieved through precision ground slides, leadscrews, or similar advanced technologies.

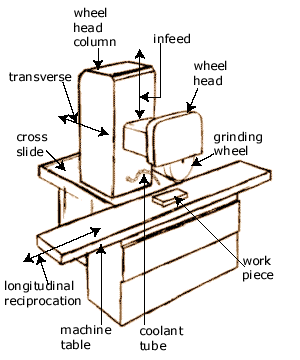
Milling machines offer a diverse range of capabilities, from basic tasks like slot and keyway cutting, planing, and drilling, to more intricate operations such as contouring and diesinking. To enhance the machining process, cutting fluid is often pumped to the cutting site. This fluid serves the dual purpose of cooling and lubricating the cutting process while also effectively removing the swarf, or waste material, generated during machining.

Milling machines can be operated manually, mechanically automated, or digitally automated through computer numerical control (CNC), making them indispensable toolsin variousindustries for achieving precise and complex machining operations. 

**2. Planing machine (Planer)**

Metal-cutting [machine tool](http://encyclopedia2.thefreedictionary.com/machine+tool) in which the work piece is firmly attached to a horizontal table that moves back and forth under a single-point cutting tool. The tool-holding device is mounted on a cross rail so that the tool can be moved across the table in small sideward movements. Since the cutting tool can be moved at almost any angle, a wide variety of grooves and surfaces can be generated. Mechanical planers, or surfacers, are also used to smooth wood to an even thickness. Planers perform the same operations as [shapers](http://encyclopedia2.thefreedictionary.com/shaper) but can machine work pieces up to 50 ft (15 m) long.

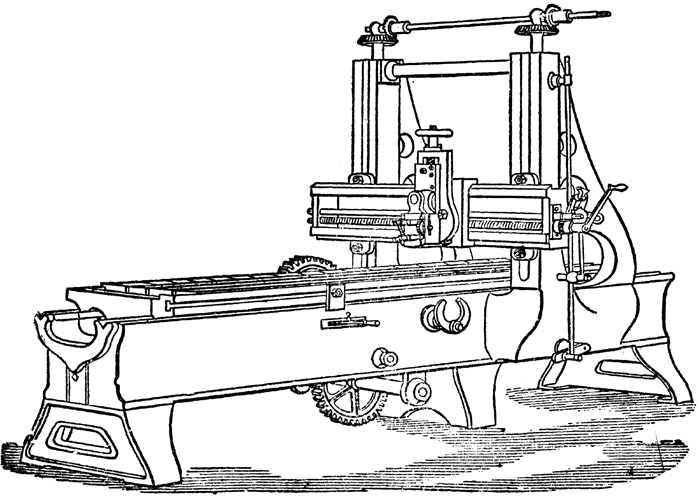
A machine for the shaping of long, flat, or flat contoured surfaces by reciprocating the work piece under a stationary single-point tool or tools.



**Milling Machine:**

A milling machine is a remarkable machine tool that revolves a circular tool featuring multiple cutting edges symmetrically arranged around its axis, commonly known as a milling cutter. The metal workpiece is typically secured in a vise and clamped to a table that offers movement in three perpendicular directions. Milling machines are equipped with a wide array of cutters, varying in shapes and sizes, tailored to accommodate a diverse range of milling operations.

The capabilities of milling machines extend to cutting flat surfaces, creating grooves, fashioning shoulders, forming inclined surfaces, crafting dovetails, and fashioning T-slots. Furthermore, these machines employ various form-tooth cutters, specifically designed for tasks such as sculpting concave shapes, crafting convex grooves, rounding corners, and meticulously cutting gear teeth.

In essence, a milling machine functions as a mechanism for removing metal from workpieces by guiding them through the periphery of a rotating circular cutter. This versatile machine tool is commonly referred to as a "miller" within the machining industry, and its applications span across a multitude of industries and precision machining tasks. 

1. **The drill press**

This is m m[achine tool](http://encyclopedia2.thefreedictionary.com/machine+tool) for producing holes in hard substances. The [drill](http://encyclopedia2.thefreedictionary.com/drill) is held in a rotating spindle and is fed into the work piece, which is usually clamped in a [vise](http://encyclopedia2.thefreedictionary.com/vise) supported on a table. The drill may be gripped in a chuck with three jaws that move radially in unison, or it may have a tapered shank that fits into a tapered hole in the spindle. Means are provided for varying the spindle speed and (on some machines) for automatically feeding the drill into the work piece. *See also* [boring machine](http://encyclopedia2.thefreedictionary.com/boring+machine). A drilling machine, in which a vertical drill, moves into the work, which is stationary.

1. **The Lathe Machine**:

A lathe, a machine tool of immense versatility, serves the purpose of securing and rotating various materials, including metal, wood, plastic, and more, against a cutting tool. This rotational action enables the creation of cylindrical products or parts and facilitates a myriad of other operations. Among its diverse functions, a lathe can drill, bore, polish, grind, thread, and perform various machining tasks. Key components of the lathe machine include:

- Headstock: Positioned at the machine's bed or base, the headstock holds one end of the material and incorporates a rotating spur.

- Tailstock: This component holds the opposite end of the material and can be moved along the bed to secure it at any desired point.

- Cutting Tool: The cutting tool is an essential element responsible for shaping and removing material.

- Power Feed: This comprises the drive and associated components that provide the necessary power for the lathe's operations.

The lathe machine stands as a fundamental machine tool, proficient in turning operations where unwanted material is efficiently removed from a workpiece that rotates against a cutting tool. Its historical significance is notable, with lathes dating back to the late 16th century in France, playing a pivotal role in the Industrial Revolution in England, especially in the context of metal cutting.

Contemporary engine lathes feature a power-driven, variable-speed horizontal spindle to which the workholding device is attached. These lathes excel in a wide range of operations, including turning cylindrical shapes, creating grooves, fashioning shoulders, crafting screw threads, and facing flat surfaces on cylindrical parts. Furthermore, internal operations encompass hole-machining tasks such as drilling, boring, reaming, counterboring, countersinking, and threading, accomplished using a single-point tool or tap.

The lathe machine, often referred to as the "father of all machine tools," earns this distinction due to its remarkable versatility. In addition to its primary function of turning cylindrical surfaces (both external and internal), it can execute various operations that are typically the domain of other specialized machines. These operations include:

- Turning: The production of cylindrical or flat surfaces, such as plumb bobs and center punches.

- Facing: The creation of flat surfaces.

- Screw Cutting: The fabrication of external and internal threads.

- Grinding: The precision machining of external and internal surfaces.

- Slotting: The process of creating slots.

- Taper Turning: The production of conical surfaces.

Parts of the Lathe Machine:

1. Bed: This provides a flat surface for mounting accessories at a consistent level.

2. Headstock: Housing the primary spindle and the mechanism for driving and controlling speed.

3. Main Spindle: Responsible for rotating the workpiece and transmitting motion to the saddle.

4. Tailstock: Used to support workpieces being turned between centers.

5. Saddle and Cross Slide: These components are instrumental in mounting tools for cylindrical work.

6. Lead Screw: Moves the saddle, determining the rate relative to the rotation of the workpiece.

7. Compound Slide: Allows the tool to move at angles other than a right angle, crucial for tasks involving conical work.

8. Centers: These support workpieces mounted at the ends.

9. Steadies: These support workpieces to prevent bending and can be either fixed or traveling types.

Work Holding Methods:

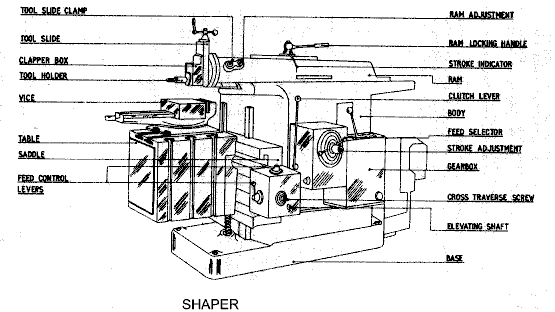
The lathe machine offers various workholding methods, including:

- Catch and Center: Utilized for workpieces placed between centers, especially when chuck mounting is not feasible.

- Face Plate: Featuring slots for clamping and securing workpieces with T-bolts.

- Chuck: This holds cylindrical workpieces securely, making it suitable for various machining setups. Common chuck types include three-jaw self-centering chucks, which efficiently grip irregularly shaped workpieces.

1. **SHAPER**



A shaper is analogous to a [planer](http://en.wikipedia.org/wiki/Planer_(metalworking)), but smaller, and with the cutter riding a ram that moves above a stationary workpiece, rather than the entire workpiece moving beneath the cutter. The ram is moved back and forth typically by a [crank](http://en.wikipedia.org/wiki/Crank_(mechanism)) inside the column; [hydraulically actuated](http://en.wikipedia.org/wiki/Hydraulic_cylinder) shapers also exist.

## Operation

Shaper linkage. Note the drive arm revolves less for the return stroke than for the cutting stroke, resulting in a quicker return stroke and more powerful cutting stroke.

A shaper operates by moving a hardened cutting tool backwards and forwards across the workpiece. On the return stroke of the ram the tool is lifted clear of the workpiece, reducing the cutting action to one direction only.

The workpiece mounts on a rigid, box-shaped table in front of the machine. The height of the table can be adjusted to suit this workpiece, and the table can traverse sideways underneath the reciprocating tool, which is mounted on the ram. Table motion may be controlled manually, but is usually advanced by an automatic feed mechanism acting on the [feedscrew](http://en.wikipedia.org/wiki/Screw_(simple_machine)). The ram slides back and forth above the work. At the front end of the ram is a vertical tool slide that may be adjusted to either side of the vertical plane along the stroke axis. This tool-slide holds the *clapper box* and toolpost, from which the tool can be positioned to cut a straight, flat surface on the top of the workpiece. The tool-slide permits feeding the tool downwards to deepen a cut. This adjustability, coupled with the use of specialized cutters and toolholders, enable the operator to cut internal and external gear tooth profiles, splines, dovetails, and keyways.

The ram is adjustable for stroke and, due to the geometry of the linkage, it moves faster on the return (non-cutting) stroke than on the forward, cutting stroke. This action is via a *slotted link* or *whitworth* link.

**USES**

The most common use is to machine straight, flat surfaces, but with ingenuity and some accessories a wide range of work can be done. Other examples of its use are:

**Evaluation**

1. State the function of the following:

* Shaping machine
* Planing machine
* Milling machine

2. State the function of the following:

* Grinding machine
* The drill press
* The lathe machine

**WEEKEND ASSIGNMENT**

1. Which of the following is a machine tool A. Circular sawing machine B. Surface planing machine C. Milling machine D. Thicknessing machine
2. Which of the following is used to rotates the work and transmits movement to saddle of a lathe A. the bed B. the headstock C. the saddle cross slide D. main spindle
3. Which of the following provides a plane surface for mounting and moving accessories at a constant level on a lathe machine A. the bed B. the headstock C. the saddle cross slide D. main spindle
4. Which of the following permits movement of tool at angle other than right angle ( e.g. for conical work) A. the compound slide B. the head stock C. the slide cross slide D. main spindle
5. The following are work holding methods except A. catch and carrier B. face plate C. saddle D. chuck

**Theory**

1. State the function of the following:

* Shaping machine
* Planing machine
* Milling machine

2. State the function of the following:

* Grinding machine
* The drill press
* The lathe machine

**WEEK TEN**

**TOPIC: FRICTION**

**CONTENT**

* **Meaning of Friction**
* **Advantages and Disadvantages of Friction**
* **How to Reduce Friction**

**Friction: Its Meaning and Applications**

Friction, a fundamental force in our daily lives, emerges when one body slides across the surface of another, generating an opposing force acting in the opposite direction of motion. This opposing force, aptly named \*friction\*, is the driving force behind countless actions and phenomena. It plays a pivotal role in the world around us, often without us realizing it.

Understanding Friction:

Friction, at its core, represents the force resisting the relative motion between two surfaces in contact. This force is indispensable in various contexts. For instance, in the realm of locomotion, friction between our shoes and the ground enables us to walk or run securely. In the automotive world, maintaining sufficient friction between a car's tires and the road is vital for forward motion.

It's worth noting two key principles:

1. The rougher the surfaces in contact, the greater the friction they produce.

2. Conversely, smoother surfaces in contact generate less friction.

Advantages and Disadvantages of Friction:

Advantages of Friction:

1. Facilitates ease of movement, allowing us to walk and run.

2. Essential for the proper functioning of brakes in vehicles.

3. Bolts and nuts rely on friction to stay securely tightened.

4. Friction prevents a ladder leaning against a vertical wall from sliding.

Disadvantages of Friction:

1. Reduces the efficiency of machines, leading to energy loss.

2. Contributes to wear and tear in machinery, necessitating frequent maintenance.

3. Hampers motion, requiring additional effort to overcome.

4. Results in the heating of engines, which can lead to performance issues.

Applications of Friction:

Friction manifests itself in various everyday applications:

1. The friction between a matchbox and a matchstick generates the heat needed to create a flame.

2. In knife sharpening, friction plays a crucial role when using a file.

3. Pencil sharpening relies on friction between the sharpener blade and the pencil.

4. Flooring materials in homes and offices are chosen for their high friction properties, providing secure footing.

How to Reduce Friction:

Managing friction can be essential in certain scenarios, and several methods can achieve this:

1. Lubricating: This method involves applying substances like oil and grease to surfaces, rendering them smooth and slippery, thereby reducing heat, wear, friction, and vibration during surface interactions.

2. Polishing: Smoothing and polishing surfaces can reduce the friction generated during contact.

3. Streamlining: Altering the shape of an object can minimize friction by reducing air resistance.

4. Use of Belt Drives and Pulleys: Employing belt drives and pulleys can efficiently transfer motion while reducing friction.

Exploring the World of Friction:

Friction is a captivating force with numerous practical implications. From enabling our daily activities to affecting the efficiency of machines, its influence is undeniable. Understanding how to harness or minimize friction is key to optimizing various processes and ensuring the smooth functioning of countless devices and systems.

Weekend Assignment:

1. Lubricant oil and grease in engines are used to reduce \_\_\_\_. A. Tension B. Friction C. Gravity D. Magnetic

2. A force that can slow moving objects is called \_\_\_\_. A. Gravity B. Magnetic force C. Contact force D. Friction

3. \_\_\_\_ helps to reduce friction due to the shape of an object. A. Polishing B. Streamlining C. Lubricating D. Driving

4. Materials used for making floors in homes and offices must be of \_\_\_\_. A. Low friction B. Equal friction C. Unequal friction D. High friction

5. Which of the following is not a method of reducing friction? A. Heating B. Lubricating C. Streamlining D. Polishing.

Theory:

1. List four applications of friction.

2. State two advantages and two disadvantages of friction.