

VAYU EDUCATION OF INDIA

MACHINE DRAWING

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Principles of Drawing

1.1 INTRODUCTION

Drawing is a language and language has great usefulness. We are familiar with the languages of the written word, mathematics and music. They are used throughout the world so that people can communicate with one another. Whether a story is to be read, a song is to be sung or an equation is to express a physical truth, language is essential to understanding among peoples.

Drawing is a language that can be learned and used like any other. There is of course, drawing as related to art, where creative expression evolves a form unique to the particular artist. The results can be of great inspiration and pleasure to those who view the finished artwork.

Engineering drawing is the graphic language of engineers. It is a graphic representation of thinking, planning and technical language of every technical person uses to communicate his ideas clearly to the other engineers.

Before starting, manufacturing or construction work, product to be developed or plan of housing society, is firstly drawn on paper. The purpose of these drawings is to define actual shape and size of a particular object by means of lines and other useful informations about the object. In an age of automation, the field of engineering drawing has greatly enhanced. Without the fundamental knowledge of engineering drawing the student would not succeed in any field of industry. There are many uses of engineering drawing in practical life, especially in modern industries.

For example, for a set up construction of thermal power plant, cement plant, chemical plant, petro-chemical plant and nuclear power plant, etc. In production shop without the knowledge of engineering drawing, engineers are handicapped. Even today in marketing, engineering drawing plays an important role.

Engineering drawing is widely used in machines, automobiles, aeronautical, chemical, marine, electronics, computer and in electrical engineering. To describe an engineering machine component which gives the correct shape and size along with the dimensional tolerances for understanding of the important. In civil and architecture, engineering drawing is used to draw the plan and elevation of buildings.

The application of engineering drawing in electrical, electronics, instrumentation and computer science are usually to prepare electrical wiring drawing, printed circuit board drawings, installation drawing, process drawing and pictorial drawing, etc.

1.2 MACHINE DRAWING

Machine drawing is the art of representation of mechanical engineering objects such as machine and various machines parts, etc. on a drawing sheet. So, machine drawing provides the theoretical background of the various machine parts but also gives a sound practical outlook to the mechanical engineering students.

The machine drawing book is devoted to introduce the different ideas, techniques to the engineering students.

1.3 DRAWING INSTRUMENTS

Drawing instruments are used to prepare drawings easily and accurately. A neat and clean drawing is prepared with the help of good quality of drawing instruments. The students must know the proper use of drawing instruments.

The following instruments are commonly used for the preparation of engineering drawing:

1. Drawing board
2. Drawing sheet
3. Mini drafter
4. Tee-squares
5. Set-squares (45° and $30-60^\circ$)
6. Protector
7. Drawing instrument box, containing:
 - (i) Large compass
 - (ii) Bow compass
 - (iii) Large divider
 - (iv) Bow divider
 - (v) Inking pen
 - (vi) Lead
8. Drawing pencils
9. Cello tape
10. Eraser
11. French curves
12. Circle master
13. Knife cutter
14. Duster (a piece of cloth)
15. Sand paper
16. Sketch book

(1) Drawing Board

Drawing board is used for fixing the drawing sheet by means of cello tape as shown in Fig. 1.1. It should be made of well seasoned soft wood of yellow pine. This wood is free from knots and oily

grains. Its surface should be perfectly smooth. Drawing boards are available in different sizes in the market. As per IS: 1444:1989 the size of drawing boards are given in Table 1.1.

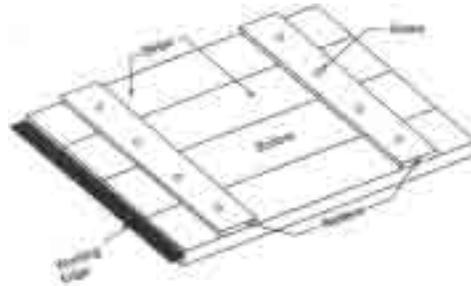


Fig. 1.1

Table 1.1

S.No	Designation	Size (in mm)
1.	B ₀	1500 × 1000 × 25
2.	B ₁	1000 × 700 × 25
3.	B ₂	700 × 500 × 15
4.	B ₃	500 × 350 × 15
5.	B ₄	350 × 250 × 15

(2) Drawing Sheet

Drawing sheets (See Fig. 1.2) are available in many varieties in the market. For engineering students it is advisable not to use the chart paper, The trimmed size of white drawing sheets are recommended for engineering students. The various sizes of drawing sheets are used as per IS : 10711-1983 are shown in Table 1.2.

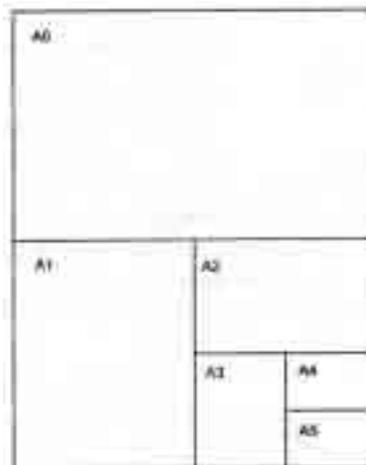


Fig. 1.2

Table.2

S.No.	Designation	Size (in mm)
1.	A ₀	841 × 1189
2.	A ₁	594 × 841
3.	A ₂	420 × 594
4.	A ₃	297 × 420
5.	A ₄	210 × 297
6.	A ₅	148 × 210

(3) Mini Drafter

The function of mini drafter has the combined advantages of tee-square, set-square, and protractor as shown in Fig. 1.3. It is mounted at the left end on the drawing board means of a Knob. It is a multi.purpose machine and useful device to prepare drawing n and quickly.

The mini drafter consist of two blades always parallel to their original position, fix a circular disc in such a way that they can move freely and smoothly on the drawing board. The blades may be set at any desired angle with the help of circular disc, which act protractor. The bigger version of this mini drafter is known as drafting machine, whi permanently fixed on a large drawing board.

Mini drafter is commonly used by the college students and draftsmen in the d department. It consist of two blades which are always parallel to their original posi fixed on a c reular disc in such a way that they can be moved freely on circular disc, which as a protractor.

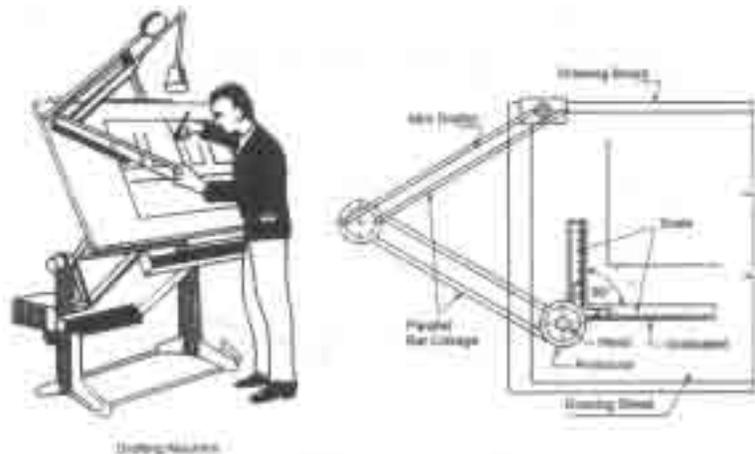


Fig. 1.3

Care of Instruments

- (i) Zero of adjustable circular disc marking should be coincide when its blade axe in horizontal and vertical positions.

- (ii) Fixed end should not move with the movement of the blades of mini drafter.

(4) Tee-square

The tee-square should be made of well seasoned hard wood, such as teak as shown in Fig. 1.4.

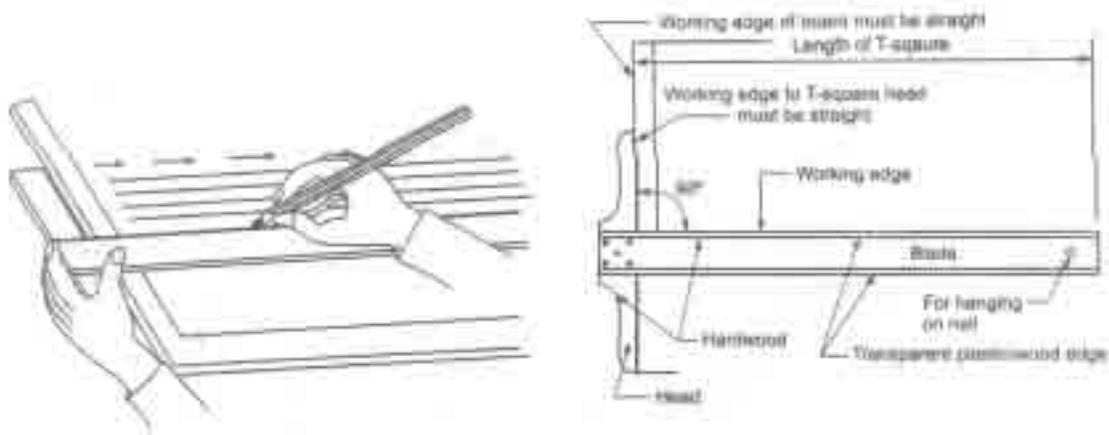


Fig. 1.4

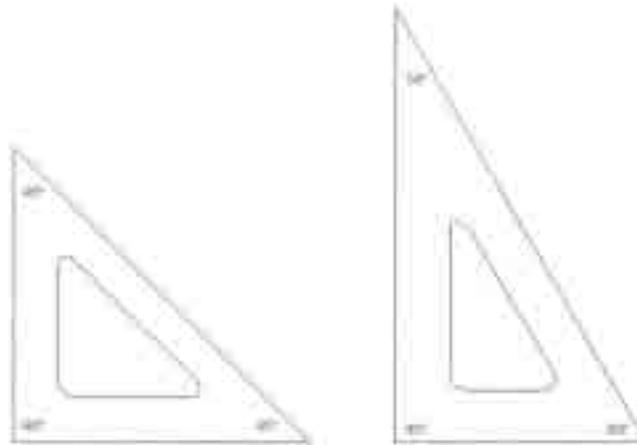
It consists of two parts, stock and the blade which are joined together at a right angle to each other by means of screws. The stock is placed along the working edge of the drawing table, which is always on the left side of the students, and slides on it when ever required. It is used to draw horizontal lines and parallel lines. The clear length of the blade should be more than the drawing board length.

Care in Handling of Tee-square

- (i) Clean the blade with cloth to remove pencil graphite lead.
- (ii) It should always be kept on drawing board, even when not in use.
- (iii) Lower edge of tee-square should not be used for drawing horizontal lines. \
- (iv) Do not use tee-square for any rough purposes.

(5) Set-squares

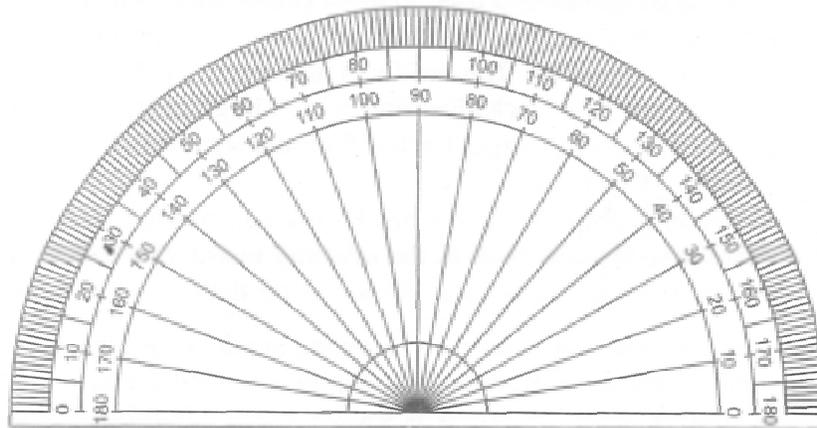
Set-square are used in combination for drawing all straight lines except the horizontal lines which are usually drawn with T-square as shown in Fig. 1.5.

**Fig. 1.5**

The set-squares are made of transparent sheet of celluloid or plastic material in various sizes. They are available in the shape of triangles with one right angle corner in each at right angle. The set-square of 45° triangle and 30-60° triangle of 200 mm and 250 mm length are available in the market for ordinary work. Two set-squares are used simultaneously along, with the tee-square produce lines for making angles of 15°, 30°, 45°, 60°, 75°, 90° and 105° etc. A circle can be divided in 6, 8, 12 and 24 parts using set-squares. Hatching lines are also drawn by the helps of set squares.

(6) Protector

The protector is used for marking and measuring such angles which can not be drawn by set-squares. The protractor of semi-circular shape shows an angles from 00 to 1800 as shown in Fig. 1.6. It is made of transparent celluloid or plastic sheet.

**Fig. 1.6**

(7) Drawing Instrument Box

A standard set of drawing instrument box is used by engineering students, containing large compass, bow compass, large divider, bow divider, inking pen and pencil lead, etc. as shown in Fig. 1.7.

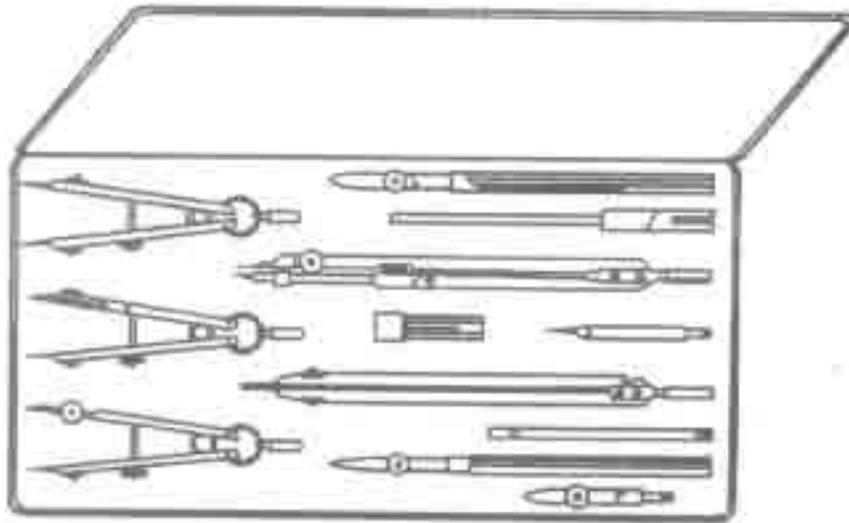


Fig. 1.7

Drawing instruments are made of nickel, silver with a silvery lustre on the surface and is corrosion resistant. The other parts like divider point, ruling pen, nibs and spring parts are made of hard steel.

(i) Large Compass: The large compass is used to draw circles and circular arcs. It consists of two legs pivoted at the top. A pointed needle is fitted at the lower end of one leg, while in the other leg a pencil lead is inserted. The needle is accurately guided into position at the centre and the circle is drawn in a clockwise direction. A large compass can draw a circle upto 120 mm.diameter. For drawing larger circles, both the legs of the compass are bent at the knee joints as shown in Fig. 1.7(a) (i).

The needle point of the compass should not be pressed too much otherwise, hole is produced on the drawing sheet as well as in the drawing board. For better working of the compass, the leg containing lead of pencil should be shorter than the needle point of the leg.

(ii) Bow Compass: A bow compass is used for drawing small circles and arcs upto 25 mm diameter. This compass is used by draftsmen or engineers when a large number of small circles of the same diameter are to be drawn as shown in Fig. 1.7(a) (ii).

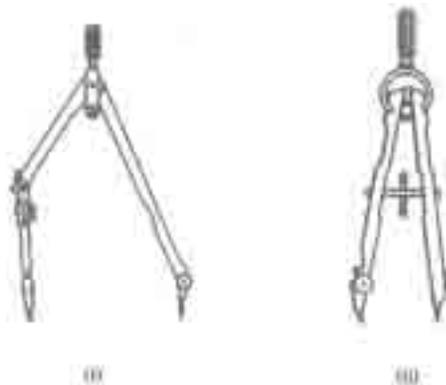


Fig. 1.7 (a)

(iii) Large Divider: The divider is used for dividing straight lines and circles into desired number of equal parts as shown in Fig. 1.7(b) (iii). It is also used for transferring distance from one part of drawing to the another part of the drawing. It has two legs, with steel points at both the lower ends instead of pencil point.

(iv) Bow Divider: The bow divider is used for dividing small circles or arcs and number of small equal distances as shown in Fig. 1.7(b) (iv).



Fig. 1.7 (b)

(v) Inking Pen: This instrument is used for inking drawing of straight and curved lines. It consists of a pair of steel nibs fitted to a metal holder. The distance between nibs of a pen can be adjusted by means of a screw to give any thickness of a line. The inking pen should be kept in vertical plane, inclined slightly at 60° , towards the direction in which the line is being drawn, as shown in Fig. 1.7(c).



Fig. 1.7 (c)

Drawing pencils are used for preparing the drawing of an object. The quality and neatness of the drawing depends upon the quality of the pencil.

The pencils lead are made of graphite mixed with varying quantities of clay to produce different degree of hardness covering with ordinary wood. Various grades of the pencil to be used, depend upon the type of the lines required as shown in Fig. 1.8.

Various companies makes pencils in the range from 9H to 7B, in which the range 7B to 2B are very soft. HB to 3H medium and 4H to 9H very hard. Where as HB pencil is used to draw extra thick lines,

e.g. border line, title block lines, etc. H pencil is used to draw thick lines, e.g. visible lines, cutting plane lines, short break lines and lettering. 2H pencil is used to draw thin lines, e.g. centre line, hidden lines, etc. and 3H pencil is used to draw faint lines, or guide lines.

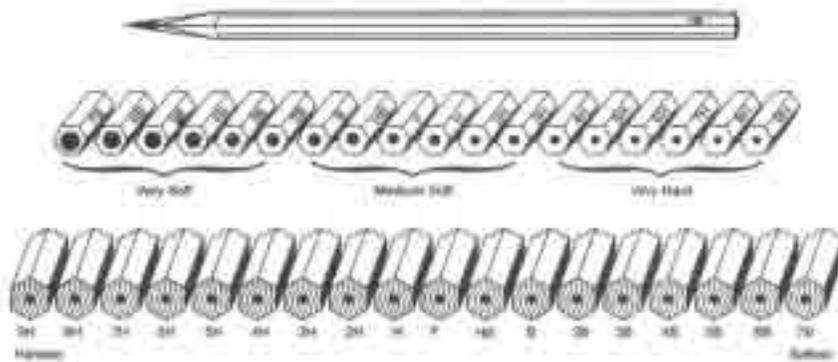


Fig. 1.8 Different Grades of Pencils

There are two ways for using the pencil to prepare the drawing:

(i) Chisel Edge Pencil: The chisel edge pencil is used to draw straight lines, to obtain uniform thickness of line as shown in Fig. 1.9 (i).

(ii) Conical Pointed Pencil: The conical pointed pencil is used for general work, e.g. lettering, dimensioning and drawing circles and arcs as shown in Fig. 1.9 (ii).



Fig. 1.9

Engineering students are recommended to use Kohinoor and Apsara brand pencils for better result.

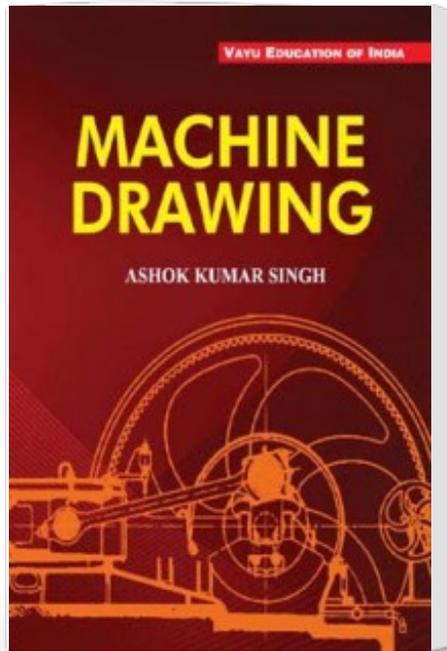
(9) Cello Tape

Cello tape is used for fixing the drawing sheet on the drawing board, before starting the work. It is made of transparent material and available in rolls of varying sizes and length.

(10) Eraser

A soft colourless and good quality of rubber is used for erasing or rubbing unnecessary lines in the drawing. Frequent use of rubber should be avoided and rubbing should be dusted-off 'by dusting cloth, as shown in Fig 1.10 .

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