Engineering Graphics

Topic : Scale

Lecture No : 3

Introduction :

A scale is defined as the ratio of the linear dimensions of the object as represented in a drawing to the actual dimensions of the same. It is not possible always to make drawings of an object to its actual size. If the actual linear dimensions of an object are shown in its drawing, the scale used is said to be a full size scale. Wherever possible, it is desirable to make drawings to full size.

Purpose of Scale Scales are used for the following purposes :

1. To prepare a drawing on a reduced scale so that large object can be accommodated on the limited size of drawing sheet. e.g. building, machine parts etc.
2. To prepare the drawing of a very small objects. e.g. parts of wrist watches, measuring instruments etc. on enlarged scale in order to give better understanding and to study the details of the minor parts of the objects.
3. To measure linear measurements of the object under measurement directly without involving any calculations.
4. To measure and set off dimensions as per scales decided upon or given before starting the drawing.

Types of scale :

Reducing Scale : It is the scale in which the actual measurements of objects are reduced and represented on the drawing sheet.
The standard proportions are : 1:2, 1:5, 1:10, 1:20, 1:50, 1:100, 1:200, 1:500, 1:1000, 1:2000, 1:5000, 1:10000 for this scale, RF < 1

Full Size Scale : In this scale the actual measurements of the objects are represented on the drawing. In this scale the usual proportion is 1:1.For this scale R.F. = 1

Enlarging Scale : It is the scale in which the actual measurements of the objects are increased in some proportion to accommodate object details on the drawing sheet.
The standard enlarging scales are : 50:1, 20:1, 10:1, 5:1, 2:1 for this scale, R.F.>1

Representative Fraction (R.F.) : The ratio of the dimension of the object shown on the drawing to its actual size is called the Representative Fraction (R.F.).

Mathematically R.F = Distance of the object on drawing / Actual distance of the object

UNITS OF MEASUREMENTS :

1 KILOMETRE = 10 HECTOMETRES
1 HECTOMETRE = 10 DECAMETRES
1 DECAMETRE = 10 METRES
1 METRE = 10 DECIMETRES
1 DECIMETRE = 10 CENTIMETRES
1 CENTIMETRE = 10 MILIMETRES

Engineers Scale :

The relation between the dimension on the drawing and the actual dimension of the object is mentioned numerically (like 10 mm = 15 m).

Graphical Scale:

Scale is drawn on the drawing itself. This takes care of the shrinkage of the engineer's scale when the drawing becomes old.

Classification of Scales : (Graphical Scale)

i. Plain scale or simple scale (✓)
ii. Diagonal scale (✓)
iii. Comparative or Corresponding Scale (X)
iv. Vernier Scale (X)
v. Scale of chords (X)

Plain Scale

1. A plain scale consists of a line divided into suitable number of equal units. The first unit is subdivided into smaller parts.

2. Distance zero should be placed at the end of the 1st main unit.

3. From the zero mark, the units should be numbered to the right and the sub-divisions to the left.

4. Mentioned the units and the subdivisions should be labeled clearly.

5. The R.F. should be mentioned below the scale.

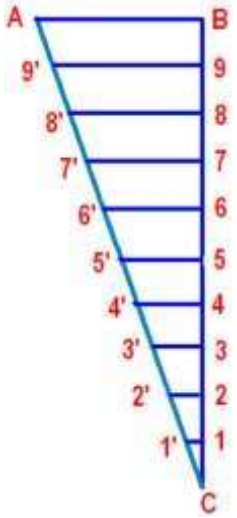
Representative fraction (R.F.) :

R.F = *length of the object on the drawing / Actual Length of the object*

Diagonal Scale

Through Diagonal scale, measurements can be up to second decimal
Diagonal scales are used to measure distances in a unit and its immediate
Immiediate two subdivisions subdivisions; of dm, cm & mm, or yard, foot & inch.
Diagonal scale is also can measure more accurately than the plain scale.

At end B of line AB, draw a perpendicular.
Step-off ten equal divisions of any length along the perpendicular starting from B and ending at C.
Number the division points 9,8,7,…..1.
Join A with C. Through the points 1, 2, 3, etc., draw lines parallel to AB and cutting AC at 1, 2, 3, etc.
Since the triangles are similar; 11 = 0.1 AB, 22 = 0.2AB, …. 99 = 0.9AB.Gives divisions of a given short line AB in multiples of 1/10 its length, e.g. 0.1AB, 0.2AB, 0.3AB, etc.

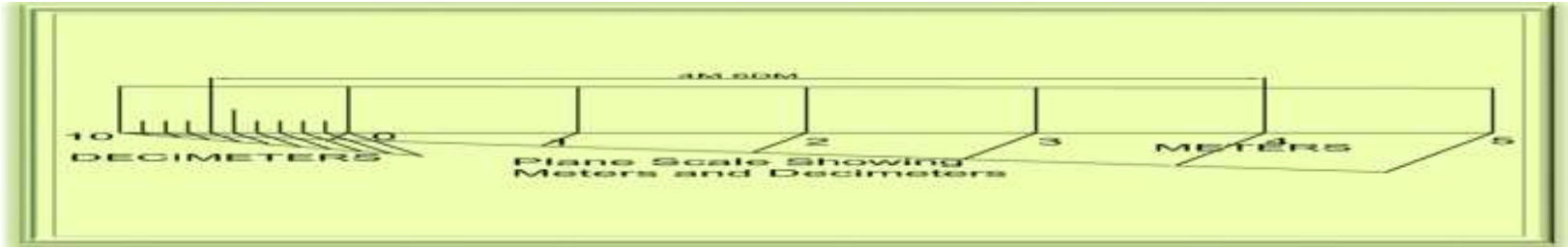


Example :

1. Draw a plain scale 1 cm = 1m to read decimeters, to measure maximum distance of 6 m. Show on it a distance of 4 m and 6 dm

CONSTRUCTION :

a. Calculate R.F.= (DIMENSION OF DRAWING /DIMENSION OF OBJECT) R.F.= 1cm/ 1m = 1/100 Length of scale = R.F. X max. distance = (1/100) X 600 cm = 6 cm
b. Draw a line 6 cm long and divide it in 6 equal parts. Each part will represent larger division unit.
c. Sub-divide the first part which will represent second unit or fraction of first unit.
d. Place (0) at the end of first unit. Number the units on right side of Zero and subdivisions on left hand side of Zero. Take height of scale 5 to 10 mm for getting a look of scale.
e. After construction of scale mention it‟s RF and name of scale as shown.
f. Show the distance 4 m 6 dm.



2. In a map a 36 km distance is shown by a line 45 cm long. Calculate the R.F. and construct a plain scale to read kilometers and hectometers, for max. 12 km. Show a distance of 8.3 km on it. (Assignment)

Example :

1. The distance between Delhi and Agra is 200 km. In a railway map it is represented by a line 5 cm long. Find it‟s R.F. Draw a diagonal scale to show single km. And maximum 600 km. Indicate on it following distances.

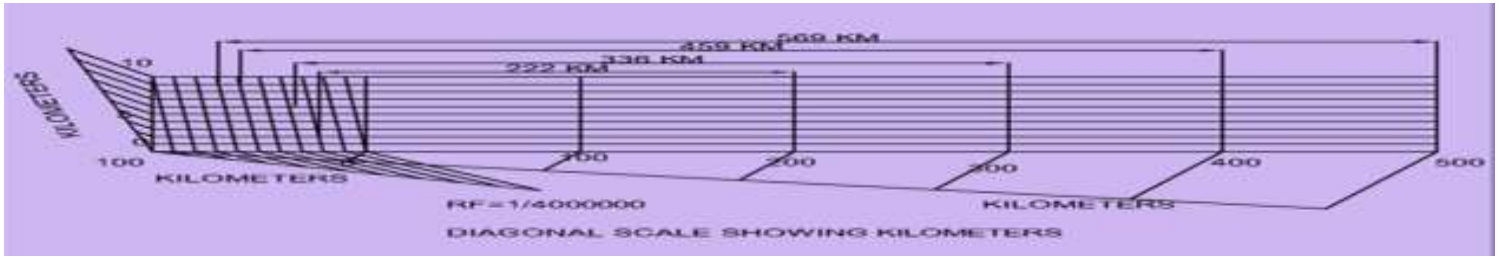
1) 222 km 2) 336 km 3) 459 km 4) 569 km

Ans :

RF = 5 cm / 200 km = 1 / 40, 00, 000

Length of scale = (1 / 40, 00, 000) X 600 X 105 = 15 cm

a. Draw a line 15 cm long. It will represent 600 km.
b. Divide it in six equal parts. Each will represent 100 km.
c. Divide first division in ten equal parts. Each will represent 10 km.
d. Draw a line upward from left end and mark 10 parts on it of any distance.
e. Name those parts 0 to 10 as shown.
f. Join 9th sub-division of horizontal scale with 10th division of the vertical divisions. Then draw parallel lines to this line from remaining sub divisions and complete diagonal scale.



2. The distance between Kolkata to Puri is 560 Km which is represented by 14 cm on a map. Find the R.F. of the scale used for drawing the map. Construct a diagonal scale to show distance up to 800 Km and show a distance of 666 Km on it.

3. Construct a diagonal scale to read kilometres and decametres, given that 1 Km is represented by 5 cm on the drawing. Mark a distance of 3.47 Km on the scale.

Thank You

Best of Luck Our Future Engineers