Module 1: SCALES

Objectives

- Learning the use of set squares/ drafter for technical drawing.

- Basic drawing skills.

- Use of scales in engineering drawing.

- Construct plain scale and Vernier scale as per requirement.

Basics

Necessity

- Drawings drawn with the same size as the objects are called full sized drawing.

- It is not convenient, always, to draw drawings of the object to its actual size. e.g. Buildings, Heavy machines, Bridges, Watches, Electronic devices etc.

- Hence scales are used to prepare drawing at
  - Full size
  - Reduced size
  - Enlarged size

Basics

Types of Scale

- ### *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.

Basics

Representative fraction (R.F.)

$$R.F. = \frac{\text{Length of an object on the drawing}}{\text{Actual Length of the object}}$$

When a 1 cm long line in a drawing represents 1 meter length of the object,

$$R.F = \frac{1\,cm}{1\,m} = \frac{1\,cm}{1\,x\,100\,cm} = \frac{1}{100}$$

Basics

Types of Graphical Scale

- **Plain Scale**

- **Diagonal Scale**

- **Vernier Scale**

- **Comparative scale**

Plain scale

Problem 4-1. (fig. 4-1): Construct a scale of 1 : 4 to show centimetres and long enough to measure upto 5 decimetres.
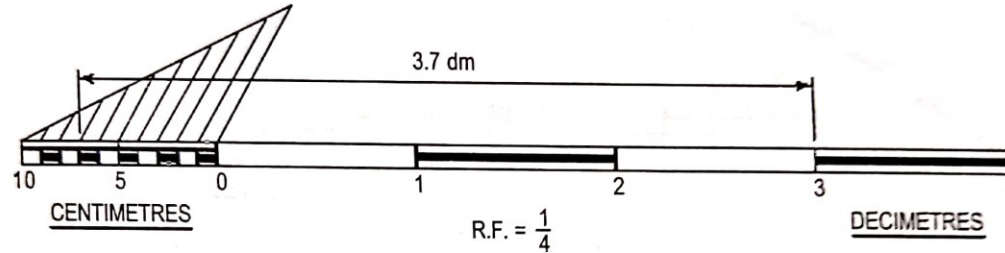

FIG. 4-1

(i)   Determine R.F. of the scale. Here it is $\frac{1}{4}$.

(ii) Determine length of the scale.

Length of the scale = R.F. × maximum length = $\frac{1}{4}$ × 5 dm = 12.5 cm.

(iii) Draw a line 12.5 cm long and divide it into 5 equal divisions, each representing 1 dm.

(iv) Mark 0 at the end of the first division and 1, 2, 3 and 4 at the end of each subsequent division to its right.

(v)   Divide the first division into 10 equal sub-divisions, each representing 1 cm.

(vi) Mark cms to the left of 0 as shown in the figure.

To distinguish the divisions clearly, *show the scale as a rectangle of small width (about 3 mm) instead of only a line*. Draw the division-lines showing decimetres throughout the width of the scale. Draw the lines for the sub-divisions slightly shorter as shown. Draw thick and dark horizontal lines in the middle of all alternate divisions and sub-divisions. This helps in taking measurements. Below the scale, print DECIMETRES on the right-hand side, CENTIMETRES on the left-hand side, and the R.F. in the middle.

To set-off any distance, say 3.7 dm, place one leg of the divider on 3 dm mark and the other on 7 cm mark. The distance between the ends of the two legs will represent 3.7 dm.

Vernier scale

- A Vernier scale consists of (i) a primary scale and (ii) a vernier.

- The primary scale is a plain scale fully divided in to minor divisions.

- The graduations on the vernier are derived from those on the primary scale.

  Least count (LC) is the minimum distance that can be measured.

  Forward Vernier Scale :

  MSD>VSD;   LC = MSD-VSD

 Backward Vernier scale:

  VSD>MSD;   LC = VSD - MSD

Vernier scale

- Length A0 represents 10 cm and is divided in to 10 equal parts each representing 1 cm.

- B0 = 11 (i.e. 10+1) such equal parts = 11 cm.

- Divide B0 into 10 equal divisions. Each division of B0 will be equal to 11/10 = 1.1 cm or 11 mm.

- Difference between 1 part of *A0* and one part of *B0* = 1.1 cm -1.0 cm = 0.1cm or 1 mm.
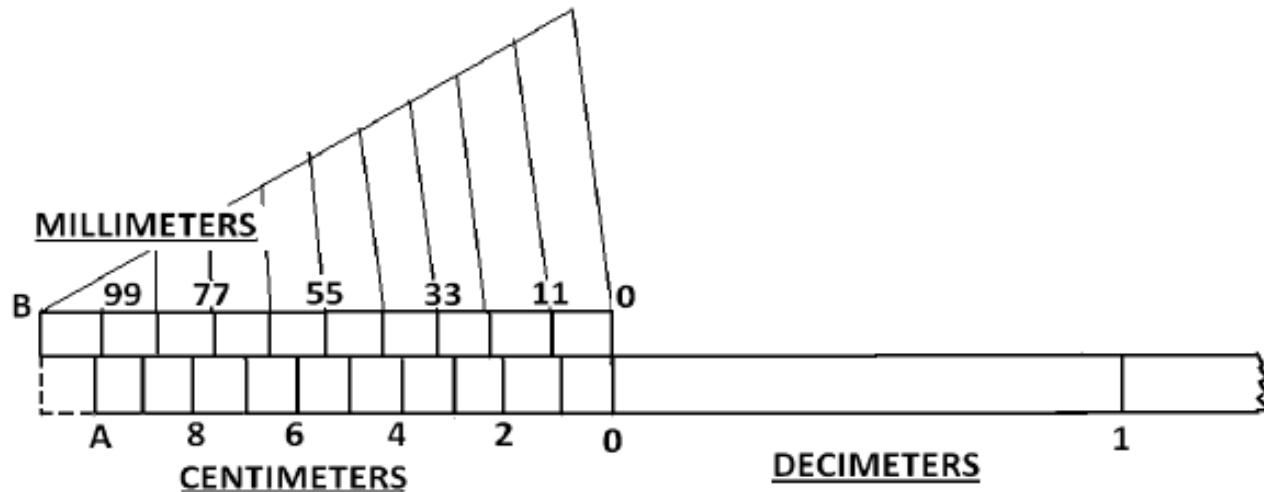
Vernier scale

Question: **Draw a Vernier scale of R.F. = 1/25 to read up to 4 meters. On it show lengths 2.39 m and 0.91 m**
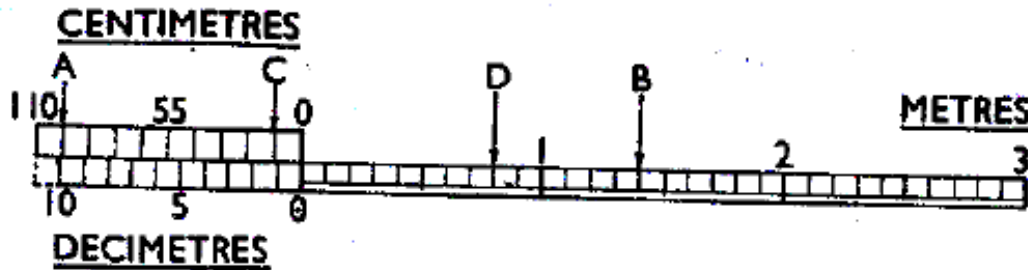
- **Length of Scale = (1/25) × (4 × 100) = 16 cm**

- **Draw a 16 cm long line and divide it into 4 equal parts. Each part is 1 meter. Divide each of these parts in to 10 equal parts to show decimeter (10 cm).**

- **Take 11 parts of dm length and divide it in to 10 equal parts. Each of these parts will show a length of 1.1 dm or 11 cm.**

- **To measure 2.39 m, place one leg of the divider at A on 99 cm mark and other leg at B on 1.4 mark. (0.99 + 1.4 = 2.39).**

- **To measure 0.91 m, place the divider at C and D (0.8 +0.11 = 0.91).**

Assignment#1

- **Construct a Vernier scale of meters to read up to centimeters when 8 cm represents 1 m. State R.F. and measure distance of 1.89 cm with the help of the scale. The scale should be long enough to measure 2 m**

Help:
https://www.youtube.com/watch?v=ajzIINxL0z0&t=1311s

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Instruction regarding format of assignments

- Assignment no. , name, roll no. should be clearly written at the top of every A4 sheet.

- Assignments are to be submitted in a single pdf file of image(s) of the hand drawn A4 sheet(s) in MS TEAMS. The file name should be in following format.

AX_D_XX_XXXX

Assignment number

Section A,B,C, etc

Last 2 digit of roll no.

eg, **89** for 21E80089,

09 for 21E80009, etc

First 4 letters of name in capitals