CE 181103

1st Semester
Civil & Chemical
Engg.

Engineering Graphics and Design

M-1: Construction of Vernier Scale

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$Q.3$ *Draw a scale of* $R.F. = \frac{1}{84480}$ *to show miles and furlong and long enough to measure upto* 5 *miles.*

(Question for plain scale)

Soln

$$R.F. = \frac{1}{84480}$$

Unit = Mile / furlong

Max^{m} length = 5 miles = $5 \times 8 \times 220 \times 3 \times 12$ inches.

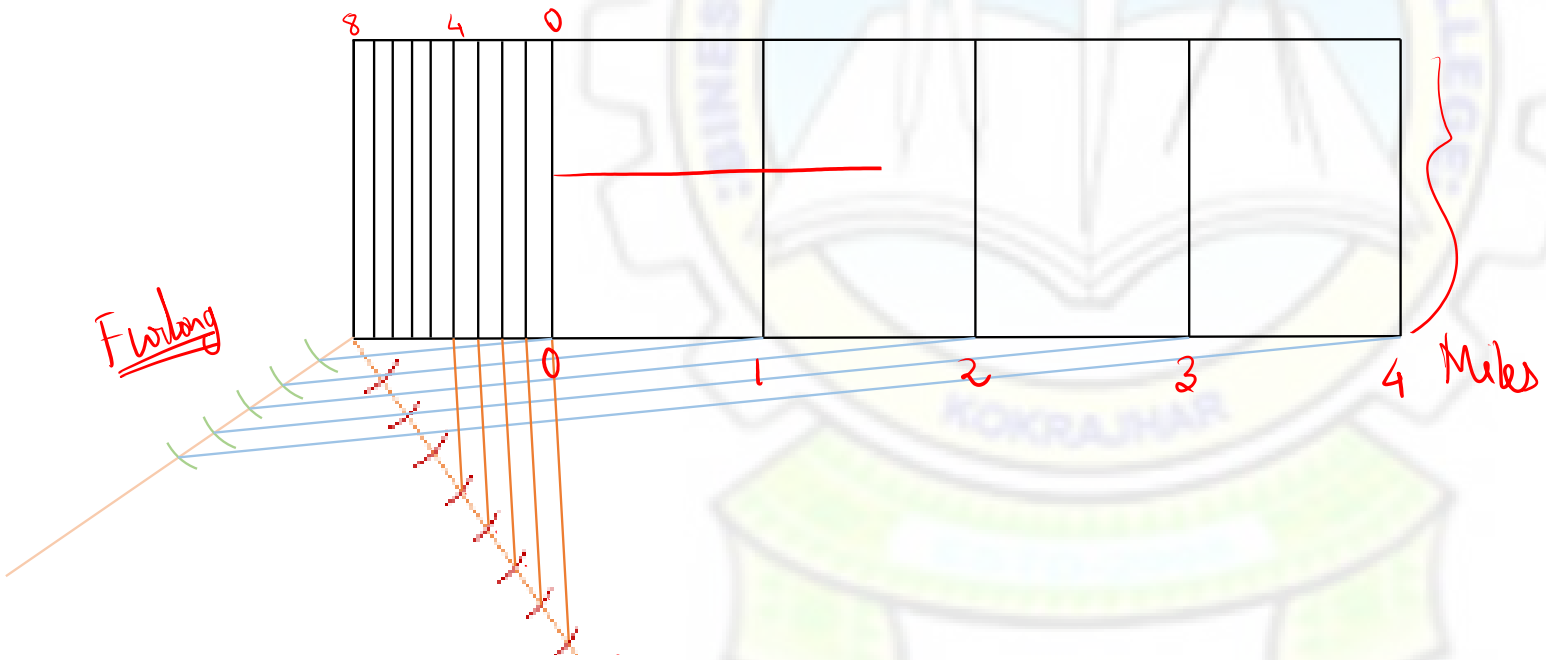
= 316800 inches

$\therefore$ Length of scale = $\frac{1}{84480} \times 316800 = 3.75$ inches.

1 mile = 8 Fur.
1 fur = 220 yard
1 yard = 3 feet
1 feet = 12 inch

2 miles 8 furlong

1 furlong



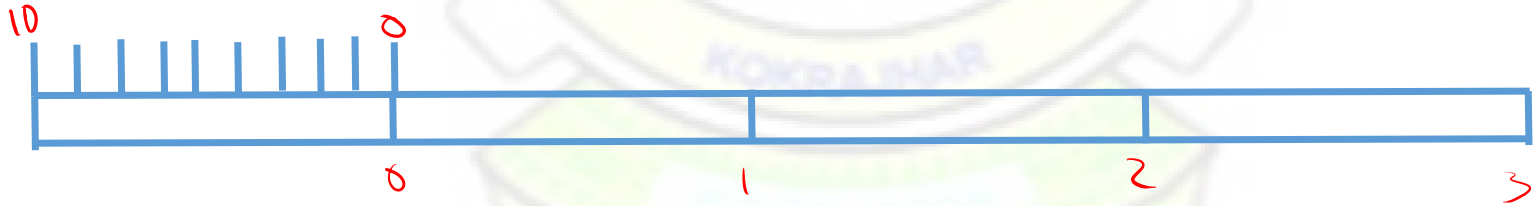
1 mile = 8 furlong.

The scales used in practice are classified as under:

(1) Plain scales
(2) Diagonal scales
(3) Comparative scales
(4) Vernier scales
(5) Scale of chords.

① When they are used
② L.C of scales

(1) Plain scales: A plain scale consists of a line divided into suitable number of equal parts or units, the first of which is sub-divided into smaller parts. Plain scales represent either two units or a unit and its sub-division.



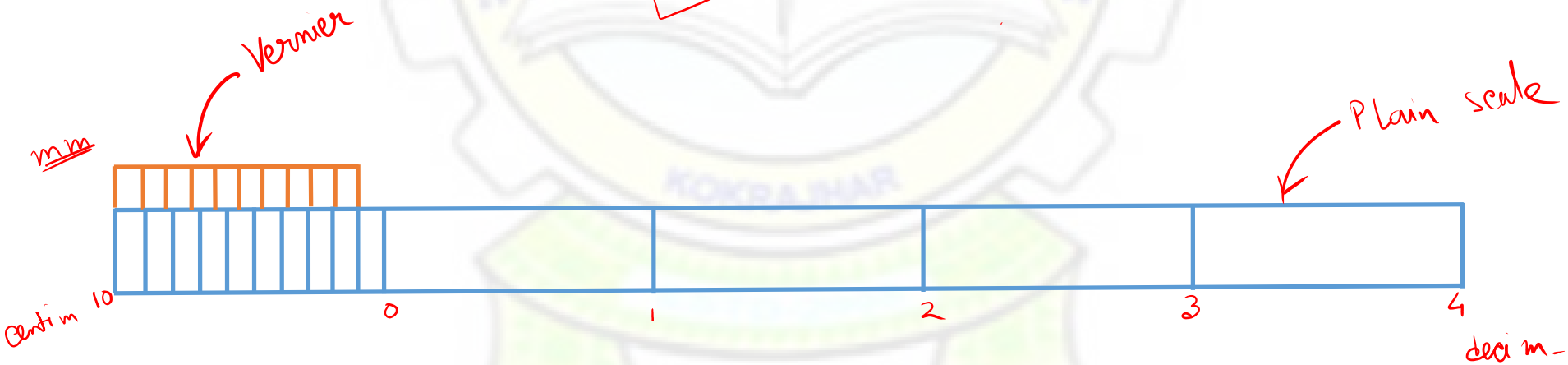
⊛ Vernier scale:

↳ Measure a length/dist with greater accuracy. (Least count = 0.01)

*Least count :→ Min^m measurment that can be recorded by an instrument.

⊛ 2 components ⟶ ① Plain scale ② Vernier

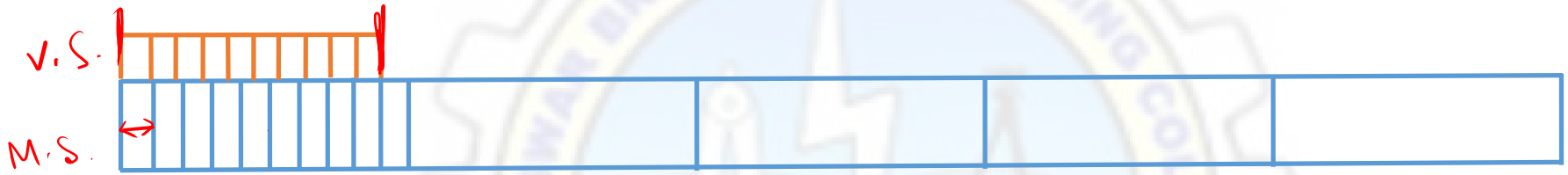
10 divisions of vernier = 9 divisions of main scale



Types of vernier

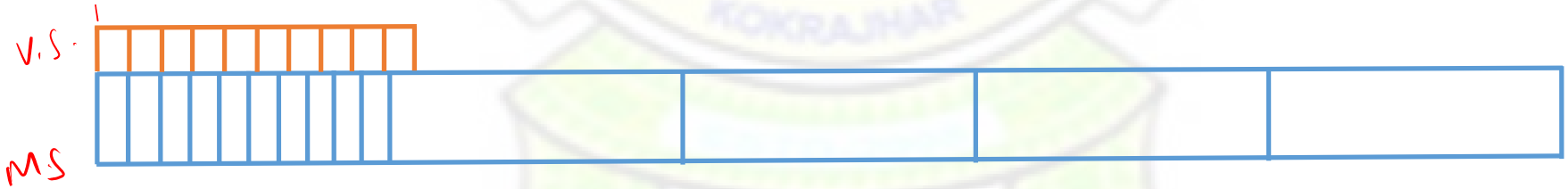
① Forward vernier :

* Main scale division > Vernier scale division.



② Backward vernier :

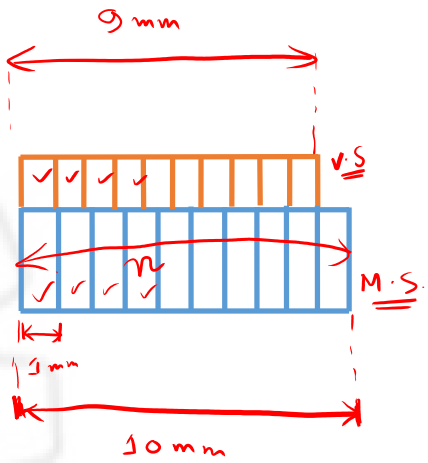
* Main scale division < Vernier scale divison



Principle of forward vernier

mm → units

10 → (n)



M.S → 'n' unit of main scale is divided into 'n' no of parts

$$1 \text{ M.S.D} = \frac{n}{n} \text{ unit}$$

V.S → (n-1) M.S.D = (n-1) unit, is divided into 'n' no of equal parts

$$1 \text{ V.S.D} = \frac{n-1}{n} \text{ unit}$$

$$\text{Least count} = 1 \text{ MSD} - 1 \text{ VSD}$$

$$= \frac{n}{n} - \frac{n-1}{n}$$

$$\boxed{\text{L.C} = \frac{1}{n} \text{ unit}}$$

⊛ Principle for backward vernier

M.S — 1 unit of main scale is divided into 'n' no of parts

$$1 \text{ M.S.D} = \frac{n}{n} \text{ unit}$$

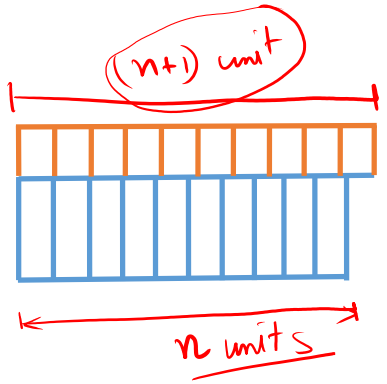
V.S — '$n+1$' MSD = '$n+1$' unit is divided into 'n' no of parts

$$1 \text{ VSD} = \frac{n+1}{n} \text{ unit}$$

$$\text{L.C.} = 1\text{VSD} - 1\text{MSD}$$

$$= \frac{n+1}{n} - \frac{n}{n}$$

$$\boxed{\text{L.C} = \frac{1}{n} \text{ unit}}$$



Q. 1 Draw a vernier scale of R.F. = $\frac{1}{25}$ to read c.m. and long enough to measure upto 5 meters.

Soln

RF = $\frac{1}{25}$, units = cm, m.

Primary → meter
Secondary → decim
Vernier → c.m

Max^m length = 5 m = 500 cm.

Length of scale = $\frac{1}{25}$ × 500 cm = 20 cm

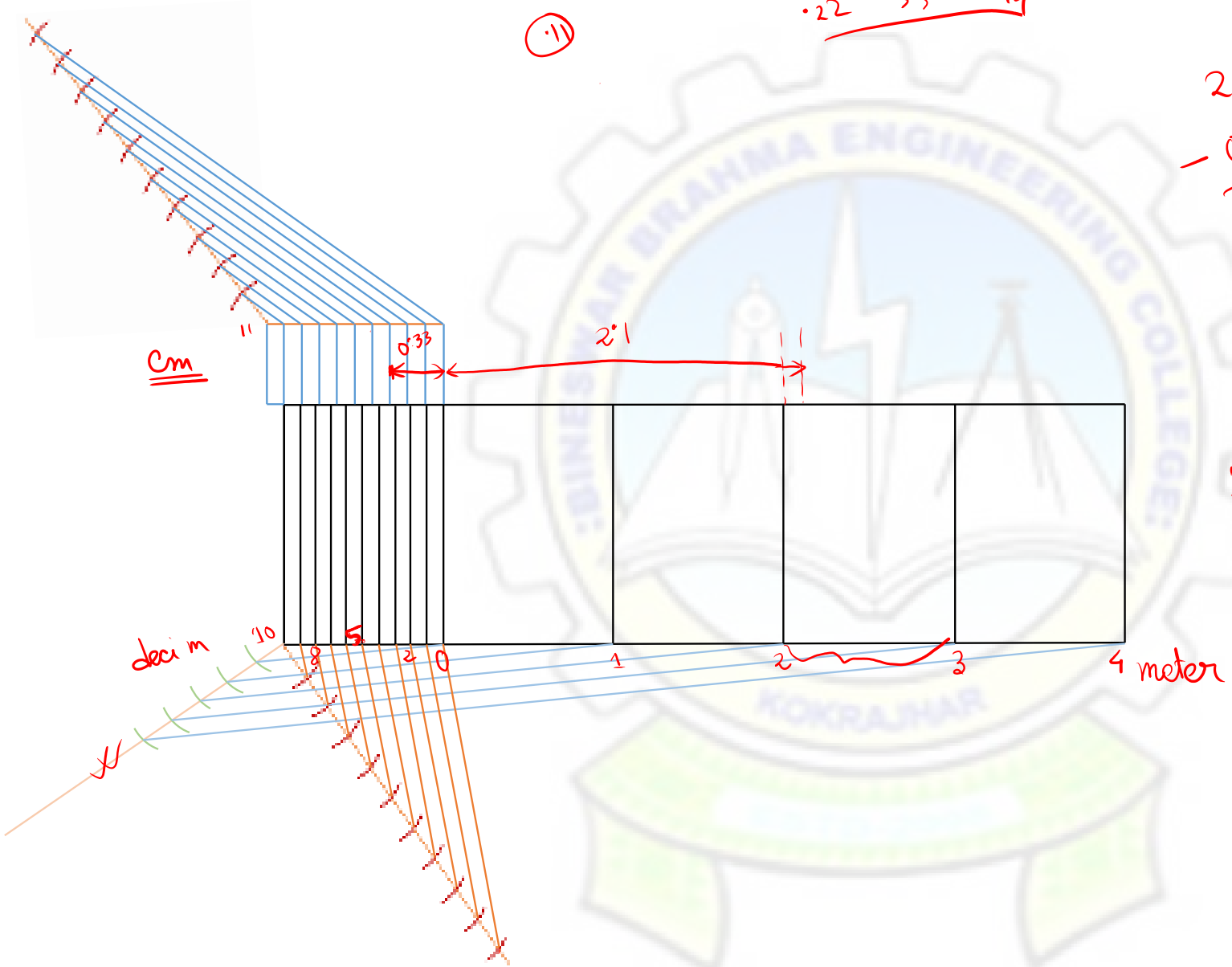
Step 1: Construct the plain scale.

Step 2: Extend the left end of 1st division towards left by an amount equal to one division of secondary scale.

Step 3: Provide some thickness to the extended part to construct the vernier.

Step 4: divide the part into 'n' no of equal divisions.

(n depends upon no of divisions considered for secondary unit)



(11)

·22 · 33 · 44

2·43
− 0·33
2·1

Q.2 Draw a full scale vernier and show the lengths 3.67", 1.54" and 0.48".

Soln

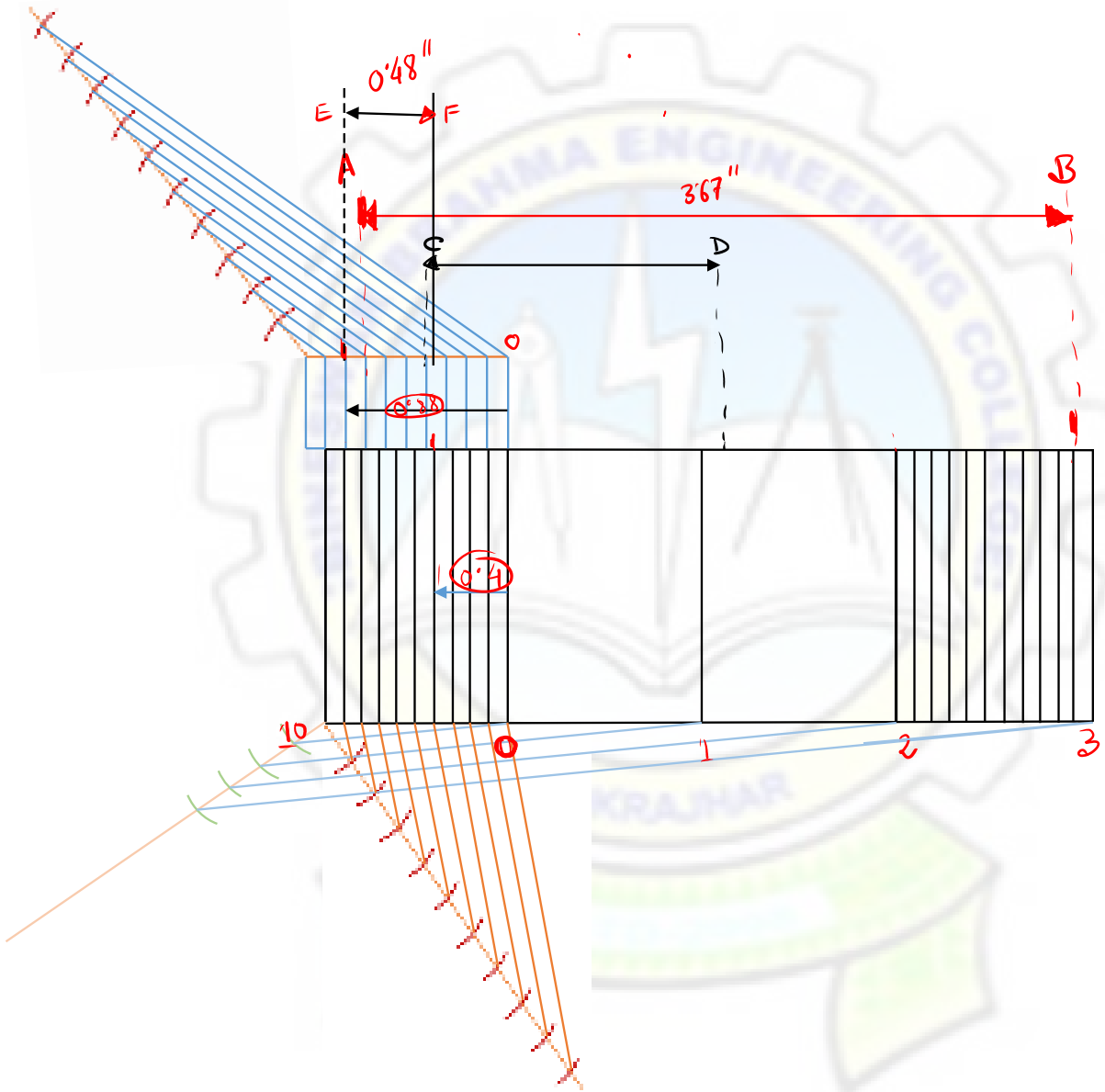
R.F = 1:1

units = inches,

Maxm length = 4 inches

Length of scale = 4 inches.

0.01



AB = 3'67"

CD = 1'54"

EF = 0'48" ✓

AB

3'67

−0'77

CD

1'54

−0'44

1'1

EF

0'48"

−0'88

−0'4

4inches

inches

$Q.3$ *Draw a vernier scale of* $R.F. = \frac{1}{80}$ *to read inches and long enough to measure upto* 15 *yards.*

Soln

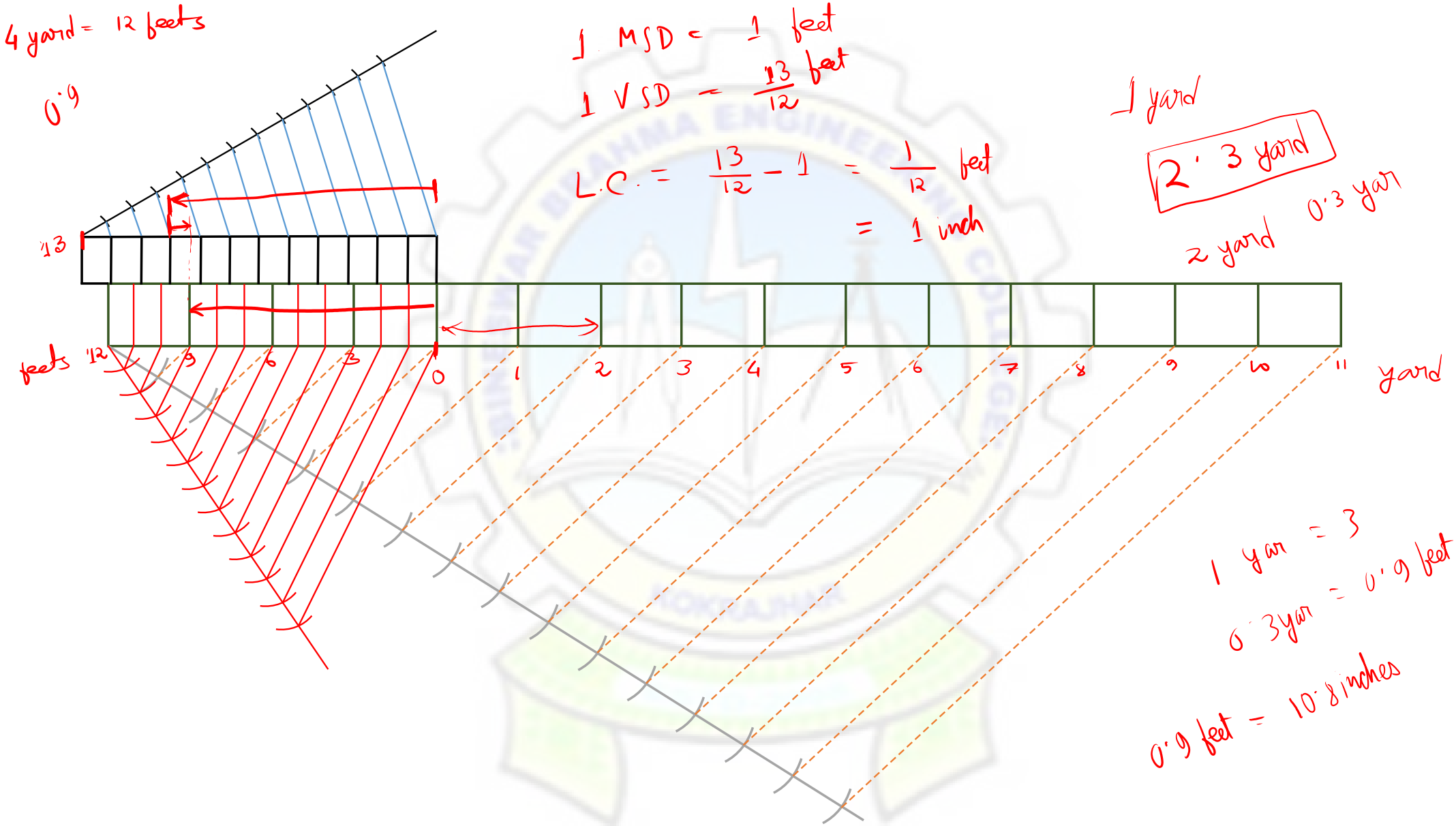
RF = $\frac{1}{80}$, Max^{m} length = 15 yards, units = yard, foot, inch

Length of scale = RF × Max^{m} length

$= \frac{1}{80} \times 15$ yards

$= \frac{1}{80} \times 15 \times 3 \times 12$ inch

$= 6.75$ inches


4 yard = 12 feets
0·9
1 MSD = 1 feet
1 VSD = 13/12 feet
L.C. = 13/12 − 1 = 1/12 feet
= 1 inch
1 yard
2·3 yard
2 yard
0·3 yar
13
feets
12
9
6
3
0
1
2
3
4
5
6
7
8
9
10
11
yard
1 yar = 3
0·3yar = 0·9 feet
0·9 feet = 10·8 inches

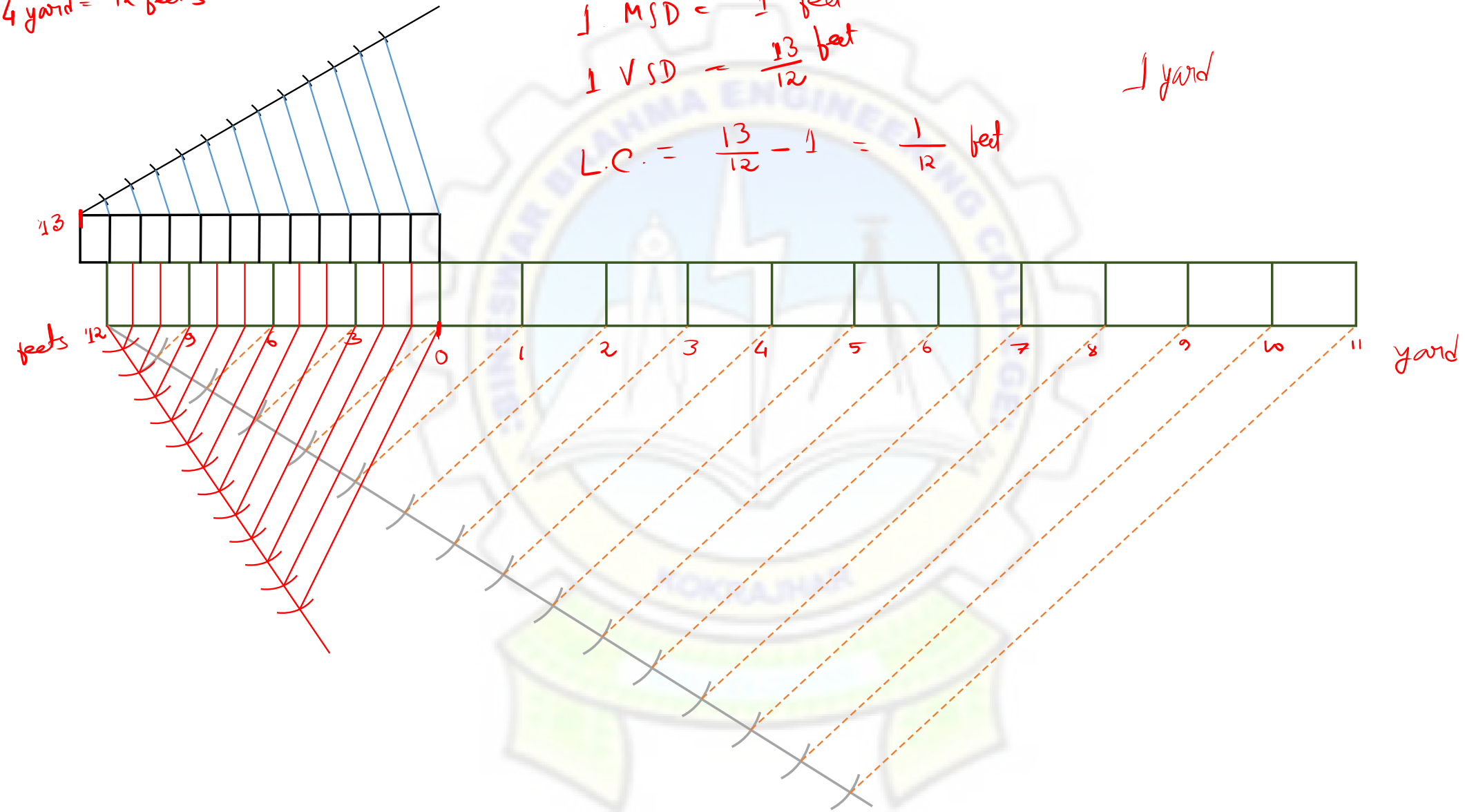
4 yard = 12 feets

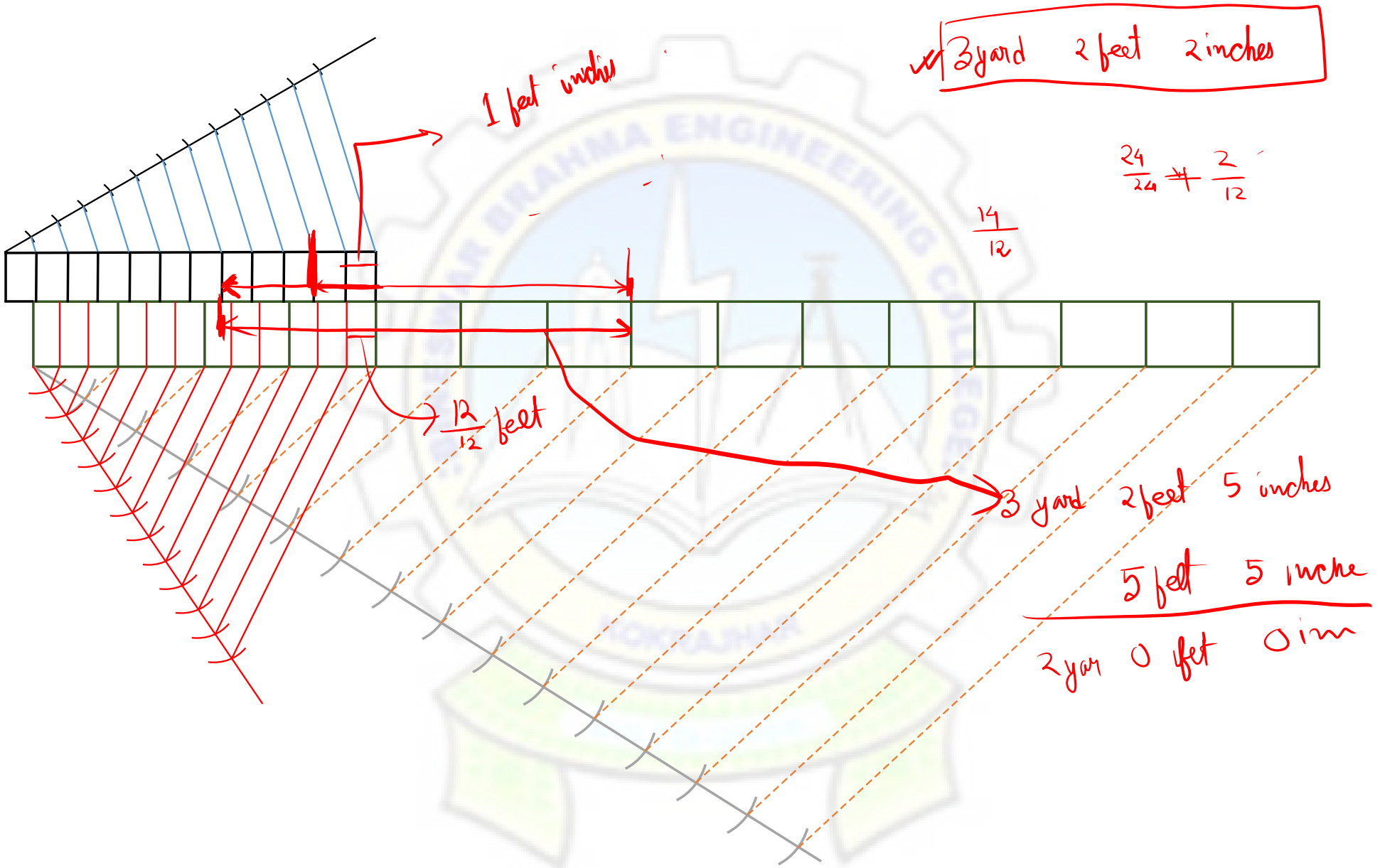
1 MSD = 1 feet

1 VSD = $\frac{13}{12}$ feet

L.C. = $\frac{13}{12} - 1 = \frac{1}{12}$ feet

1 yard




3yard 2feet 2inches
1 feet inches
24/24 + 2/12
14/12
12/12 feet
3 yard 2feet 5 inches
5 feet 5 inche
2yar 0 ffet 0in


Thank You