RADIANT 2026

Physics

Measurements and Experimentation

Lecture - 03

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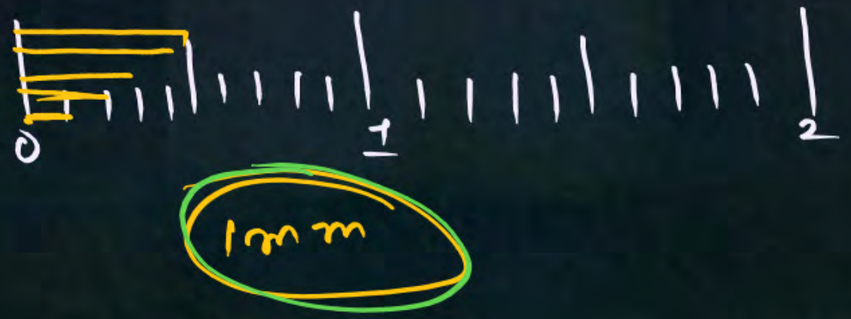
Topics *to be covered*

1. Vernier Callipers
2. Principle of Vernier
3. Least Count
4. Zero Error Vernier Callipers
5. Question's

Units of Length, Mass and Time

Recap *of previous lecture*

1. Need of Unit for Measurement
2. Unit
3. King of Unit
4. Properties of Unit
5. Units of Length, Mass and Time



100 kg लोहा → 1kg

10gm gold → 0.001gm

Question

1 quintal is equal to

A 100 kg

B 1000 kg

C 106 kg

D 1012 kg

Question

1 Fermi is equal to .....m

A 10^{-6}

B 10^{6}

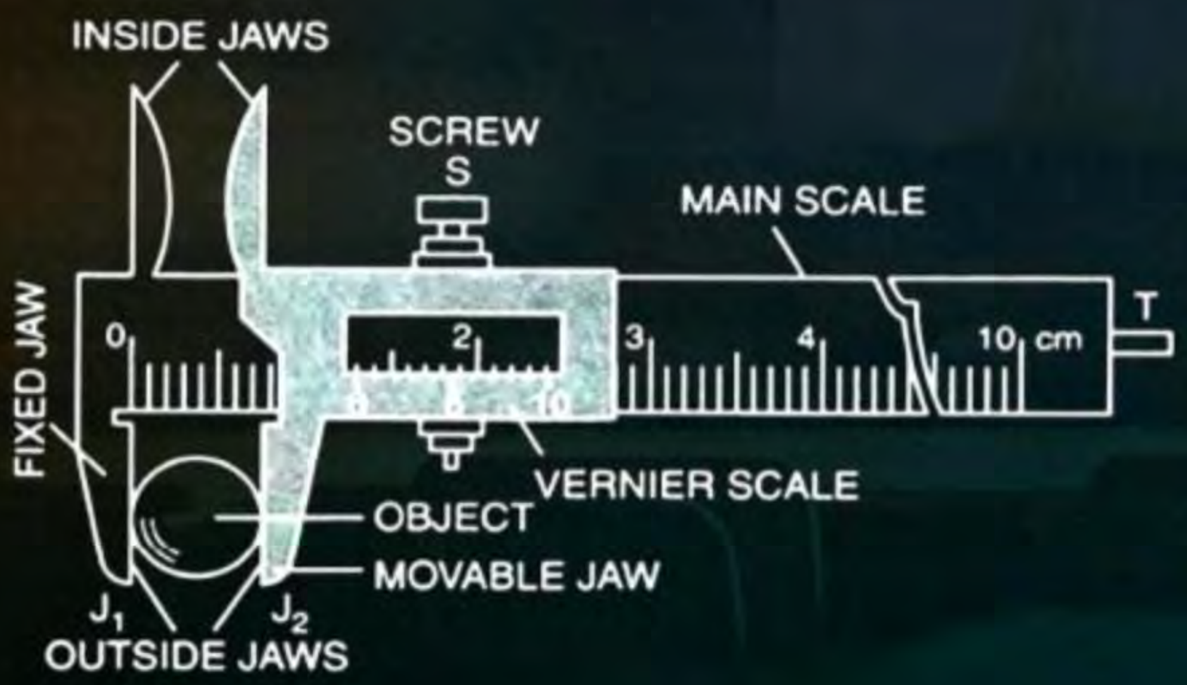
C 10^{-15}

D 10^{15}

Least Count

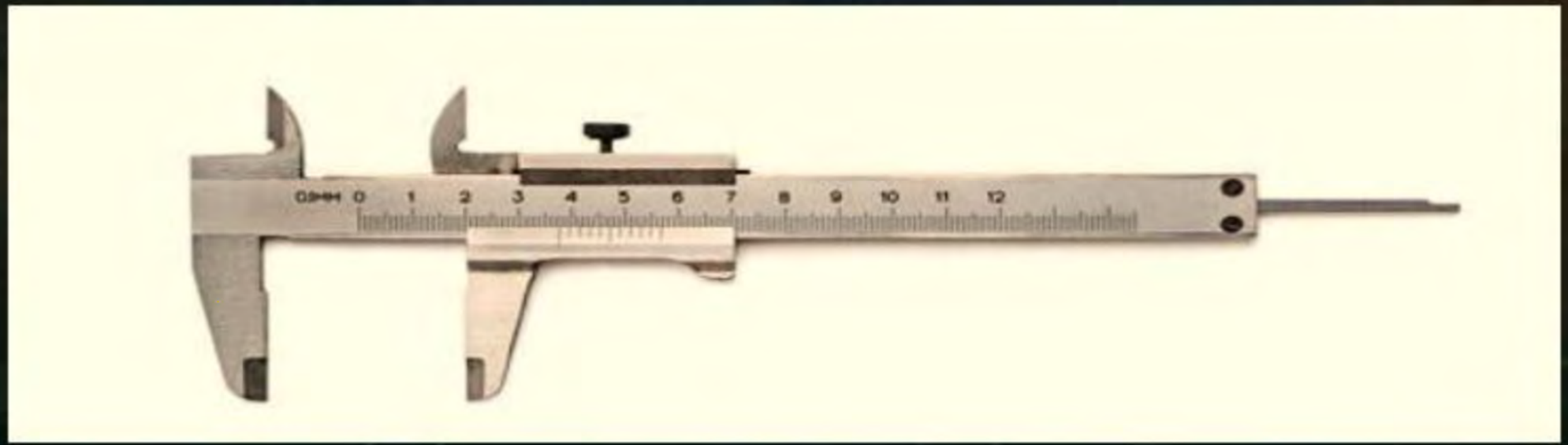
The least count of an instrument is the smallest measurement that can be taken accurately with it.

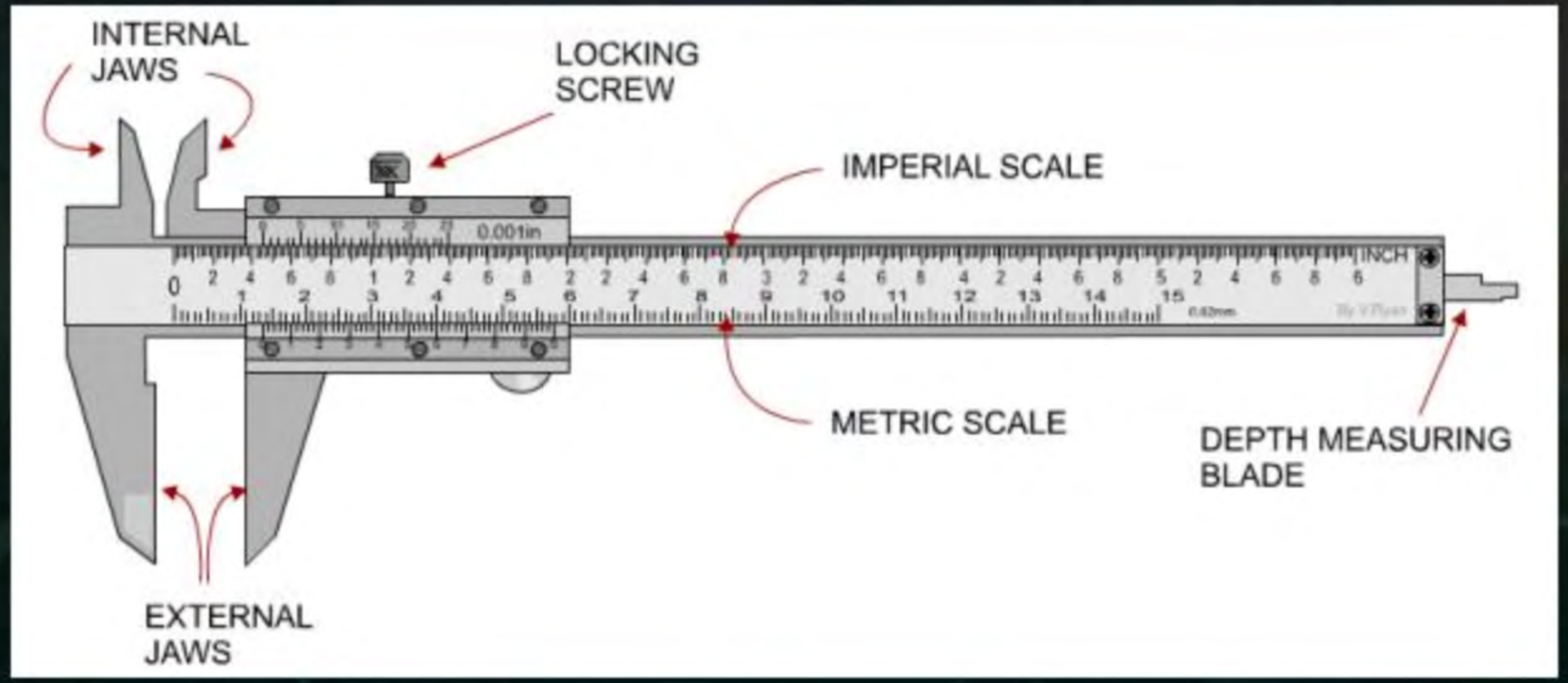
Vernier Callipers

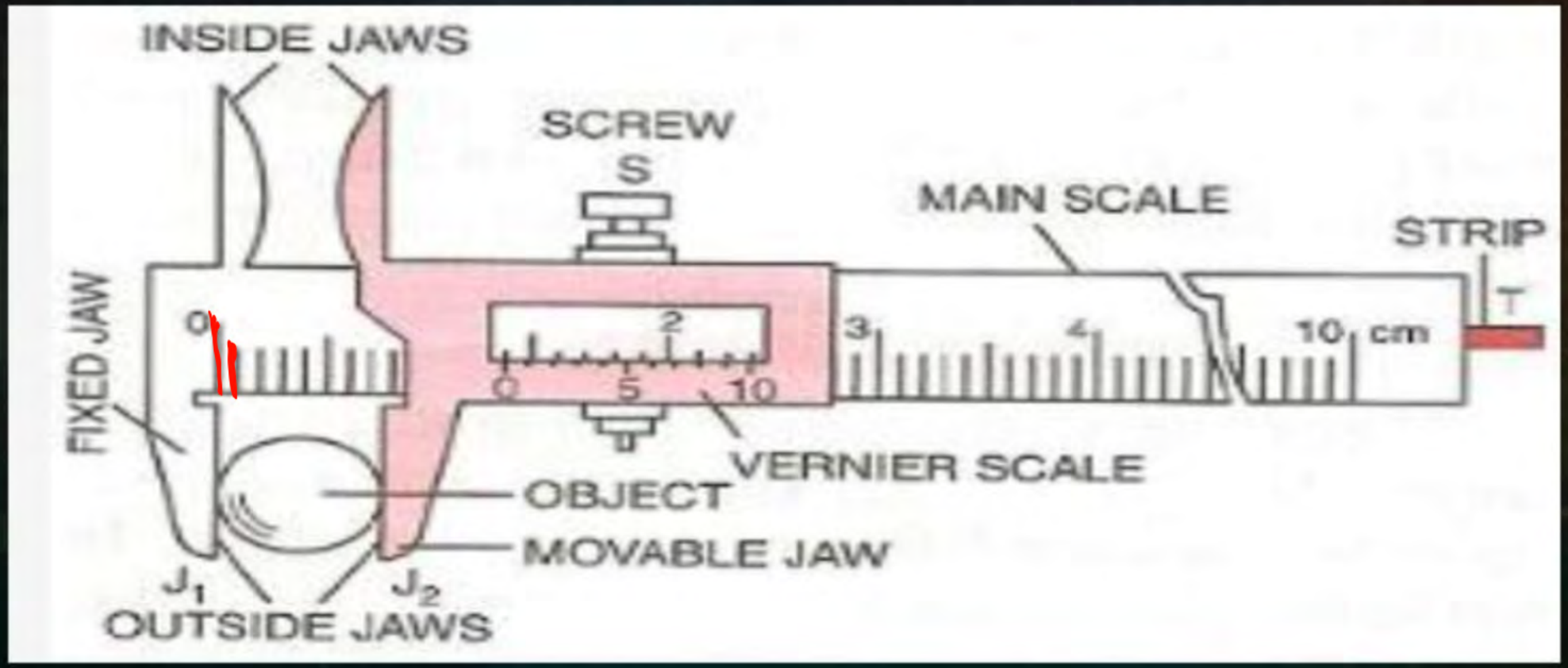


	Part	
1.	Outside jaws	To measure the length of a rod, diameter of a sphere, external diameter of a hollow cylinder.
2.	Inside jaws	To measure the internal diameter of a hollow cylinder or pipe.
3.	Strip	To measure the depth of a beaker or a bottle.
4.	Main scale	To measure length correct up to 1 mm.
5.	Vernier scale	Helps to measure length correct up to 0.1 mm.

Vernier Callipers




INTERNAL JAWS
LOCKING SCREW
IMPERIAL SCALE
METRIC SCALE
DEPTH MEASURING BLADE
EXTERNAL JAWS
0.001in
INCH


INSIDE JAWS
SCREW
S
MAIN SCALE
STRIP
T
FIXED JAW
0
2
3
4
10
cm
0
5
10
VERNIER SCALE
OBJECT
MOVABLE JAW
J_1
J_2
OUTSIDE JAWS

Principle of Vernier

Shibamji

- Pierre Vernier devised a method by which length up to 2nd decimal place of a cm i.e., correct up to 0.1 mm (or 0.01cm) can be measured. In this technique.
- Two scales are used. One scale, called the **main scale**, is fixed, while the other scale, called the **vernier scale**, slides along the main scale.
- The main scale is graduated with value of one division on it equal to 1 mm.
- The graduations on the vernier scale are such that the length of n divisions on vernier scale is equal to the length of $(n - 1)$ divisions of the main scale.

Principle of Vernier

- Generally, a vernier scale has 10 divisions and the total length of these 10 divisions is equal to the length of 10 – 1 = 9 divisions of the main scale i.e., equal to 9 mm.
- Thus each division of the vernier scale is of length 0.9 mm (i.e., smaller in size by 1/10 mm than a division on the main scale). This difference is utilized as least count for the measurement.

Least Count of Vernier or Vernier Constnat

- The least count of vernier is equal to the difference between the values of one main scale division and one vernier scale division.
- It is also called the vernier constant.

- Vernier constant or least count of vernier,
  (L.C. = value of 1 main scale division − value of 1 vernier scale division)

Least Count of Vernier or Vernier Constnat

Let n divisions on vernier be of length equal to that of $(n-1)$ divisions on main scale and the value of 1 main scale division be x. Then

Value of n divisions on vernier $= (n-1)x$

$l(=\frac{x}{n}$

$\therefore$ Value of 1 division on vernier $= \frac{(n-1)x}{n}$

(L.C. = value of 1 main scale division − value of 1 vernier scale division)

$$\text{L.C.} = x - \frac{(n-1)x}{n} = \frac{x}{n}$$

i.e., $$\text{L.C.} = \frac{\text{Value of one main scale division } (x)}{\text{Total number of divisions on vernier } (n)}$$


Thank you