



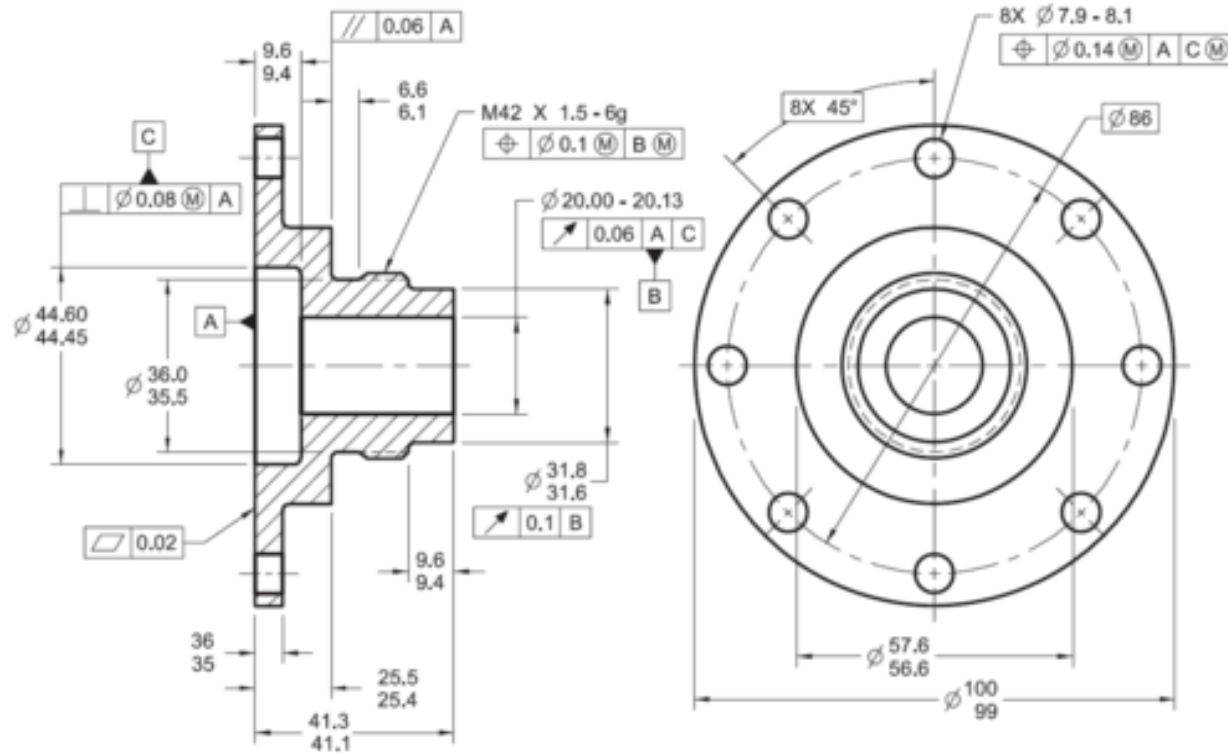
# MEASURING INSTRUMENTS

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Course : Metrology and Measurements



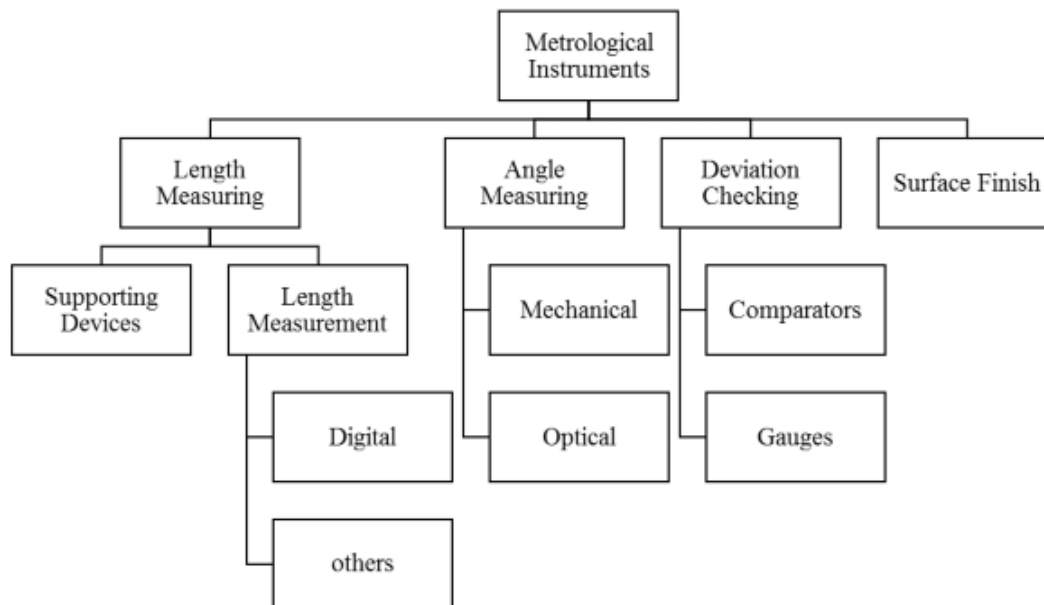
# HOW WILL YOU MEASURE ?





# INSTRUMENTS

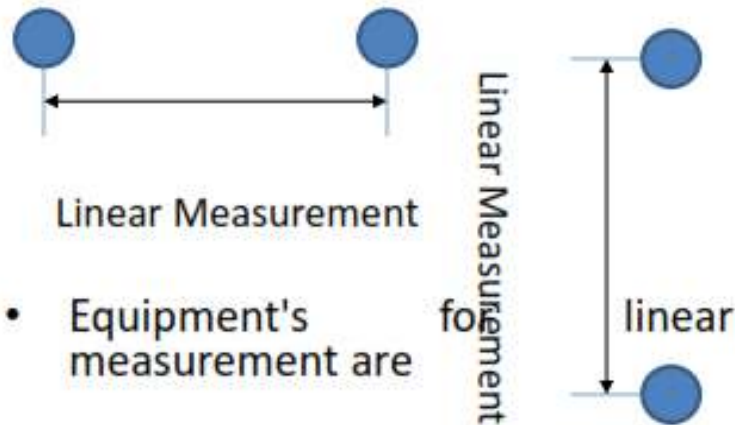
## Classification of Measuring Instruments





# Linear Measurement

- Linear measurement means **measurement between two points or planes**. It is basically related with distance between them using line or end standard.
- Non Precision
  - Steel Rule
  - Slip gauge
  - Caliper and scale
  - Feeler gauge etc.
- Precision
  - Vernier caliper
  - Vernier height gauge
  - Vernier depth gauge
  - Micrometer
  - Inside micrometer
  - Depth micrometer
- Supporting Devices



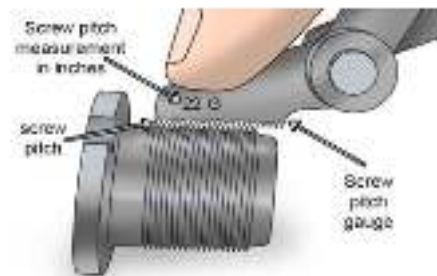
- Equipment's measurement are



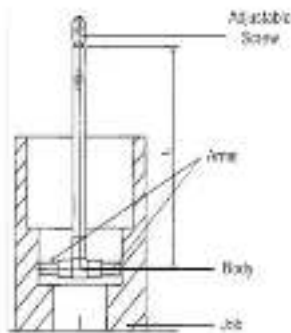


## Calipers

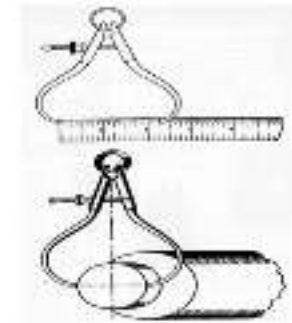
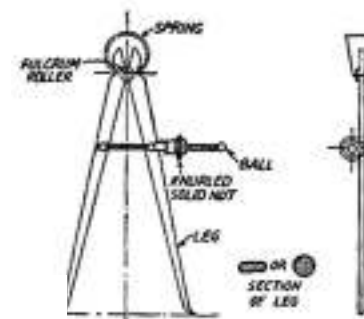
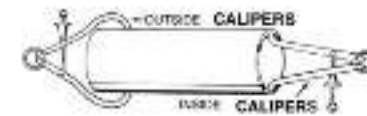
### Pitch gauge



### Telescopic gauge



*The gauge is removed from measuring cavity and dimension is measured with the aid of a micrometer or caliper.*



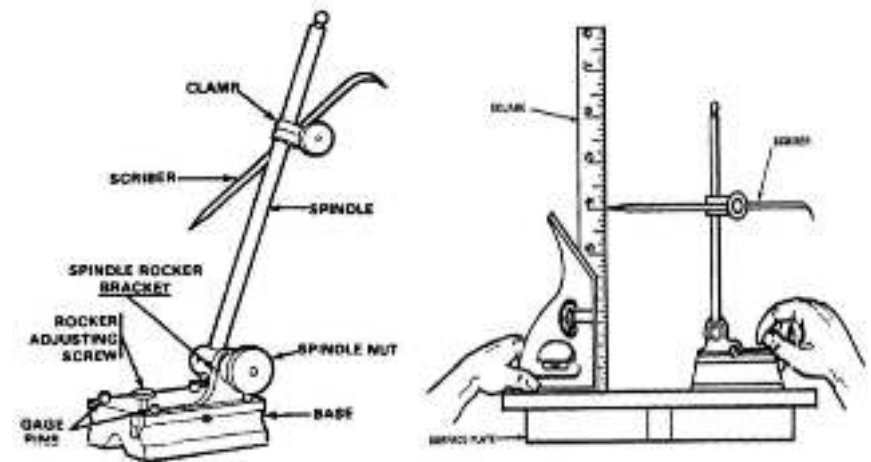


## Combination Set



*This instrument is most commonly used in layout and inspection purpose. On the square head and protractor head spirit levels are mounted for test the surface for parallelism and check on indication.*

## Universal Surface Gauge





# LINEAR PRECISION

## Verniers

- When two scales have slightly difference in sizes are use, the difference between them can be utilized for increase in accuracy of measurement.
- Types of Verniers
  - Simple Vernier
  - Vernier Height Gauge
  - Venire Depth gauge
  - Micrometer
  - Depth micrometer
  - Inside micrometer

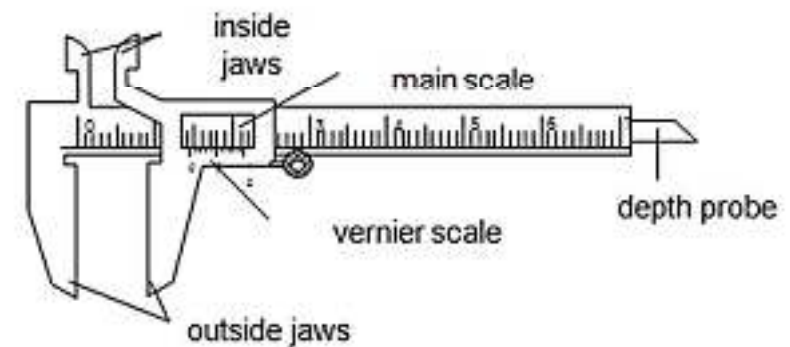




## Simple Vernier

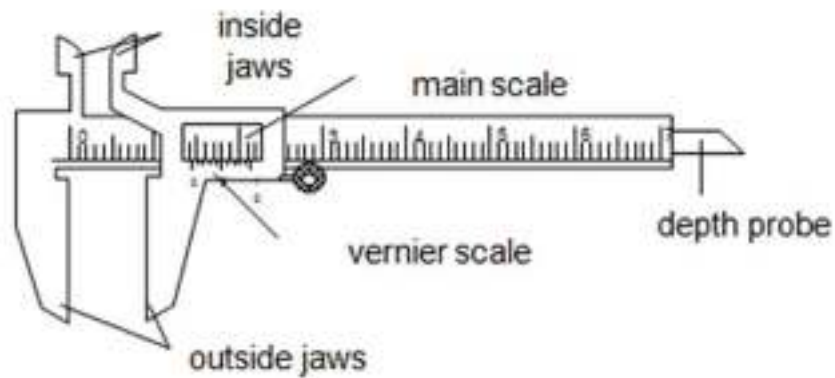
- By using vernier, following measurements can be done
  - Outside dimensions (Outside jaws in use)
  - Inside dimensions (Inside Jaws in use)
  - Depth (Using depth bar)
  - Step Measurement (Using step surface)

### Vernier





## Vernier

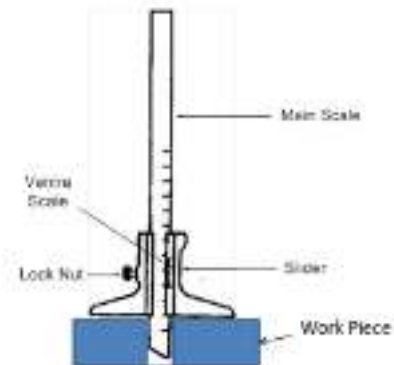


### Calculating Least Count

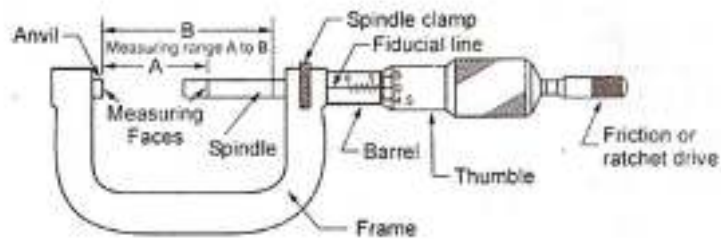
- $L.C. = \frac{\text{Smallest Division on Main Scale}}{\text{Number of Divisions on Vernier Scale}}$
- If value of smallest division on main scale is 1mm and there are 50 numbers of divisions on vernier scale then least count will be
- $L.C. = \frac{1}{50} = 0.02mm$



## Vernier Depth Gauge

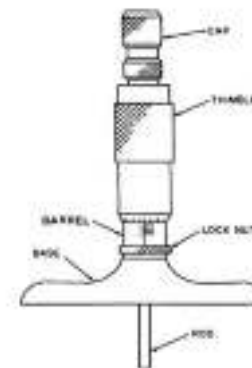


## Micrometer



Least Count of Micrometer is =  $0.01\text{mm}$  (i.e.  $0.5/50 \Rightarrow$  Smallest division on main scale is  $0.5\text{mm}$  and total divisions on vernier scale is 50).

## Depth Micrometer





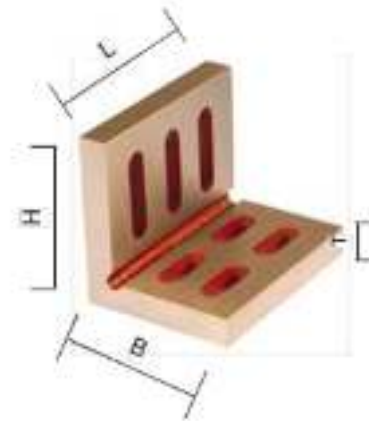
## Surface Plate



## V - Block



## Angle Plate



## Spirit level

