

# CHAPTER 1: PHYSICAL QUANTITIES

## SYLLABUS:

- ❑ Demonstrate the meaning, importance and applications of precision in the measurements
- ❑ Understand the meaning and importance of significant figures in measurements
- ❑ Explain the meaning of dimensions of a physical quantity
- ❑ Work out the dimensions of derived physical quantities applicable to this syllabus
- ❑ Apply dimensional analysis method to check the homogeneity of physical equations

## Physical Quantity:

- The quantity, which is measurable by some physical means, is known as physical quantity.
- Simply, measurable quantities are physical quantity.
- A physical quantity is a property of a material or system that can be quantified by measurement. e.g., length, mass, time, volume, density, speed etc.

It is given by,  $PQ = \text{Numerical value } (n) \times \text{unit } (u)$

Simply it is of three types:

- *Fundamental PQ:* [Mass, Length, Time, Temperature, Current, Luminous intensity, amount of substance]
- *Derived PQ:* [Velocity, acceleration, force etc.]
- *Supplementary PQ:* [Plane angle (2D), Solid angle (3D)]

## Plane Angle and Solid Angle

### Plane Angle:

- Angle between two lines meeting at the vertex.
- Its SI unit is radian.

### Solid Angle:

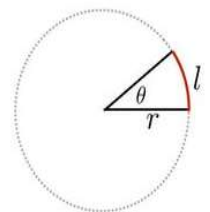
- Three-dimensional analogue of an angle.
- Angle formed by planes meeting at a point.
- Its SI unit is Steradian.
- It is denoted by  $\omega$ .

## Angles and Solid Angles

Angle: ratio of subtended arc length on circle to radius

$$\theta = \frac{l}{r}$$

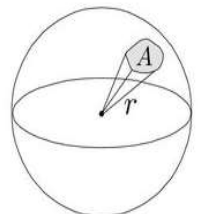
- Circle has  $2\pi$  radians



Solid angle: ratio of subtended area on sphere to radius squared

$$\Omega = \frac{A}{r^2}$$

- Sphere has  $4\pi$  steradians



## Accuracy and precision:

### Accuracy:

- Accuracy is the degree to which the observed value approaches the true value.
- It is the measurement in which the data is nearer to true value.
- It is independent of the least count of the measuring equipment.