# BASIC CONCEPTS

→ Objective of Surveying

(i) To take measurements for determining the locations of existing ground features.

(ii) To mark the positions of objects wrt. assumed datum.

(iii) To calculate the related quantities like areas & volumes

→ Primary Divisions of Surveying:

(i) Plane Surveying
- neglect the curvature of earth.
- distances less than 18.5 km and areas less than 250 $km^2$.
- less accurate.

(ii) Geodetic Surveying.
- consider the curvature of Earth.
- large areas and more accurate.
- fixing the control points and boundary points of a field.

→ Classification of Surveys

* Based on Function:-

1. Control Survey
2. Land Survey
3. City Survey
4. Engineering Survey
5. Topographic Survey
6. Geological Survey
7. Archaeological Survey
8. Astronomical Survey
9. Hydrographic Survey
10. Gravity Survey.
11. Mining Survey
12. Military Survey
13. Satellite Survey

Topographic Survey:- It is carried out to dilineate features such as hills, rivers, forests and man made features like villages, buildings, transmission lines and roads.

Hydrographic Survey:- Related with water bodies like low water level, high flood level etc.

Gravity Survey:- Fluctuation of gravity value from place to place.

* Based on Instrument:

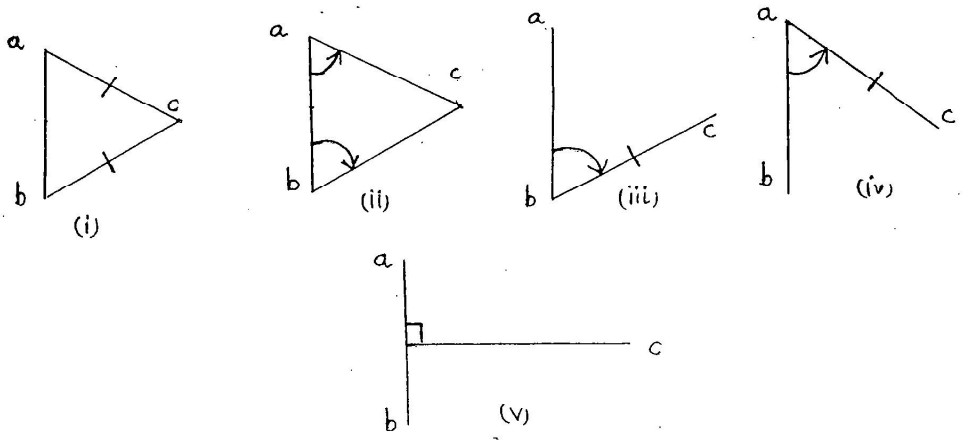
1. Chain Surveying
2. Compass Surveying
3. Plane table Surveying.
4. Levelling Surveying.
5. Theodolite Surveying
6. Photogrammetry.
7. EDM's. – Electronic Distance Measuring equipment.

- Trailetaration :-

It is the procers of measuring the sides of a triangle with the help of EDMs; esp

→ Principles of Surveying

1. To locate the point wrt two known points.



2. Working from whole to the part but not from part to a whole.

Accumulation of errors can be reduced.

→ Basic Measurements in Survey

(i) Horizontal Distance.

Done by chain, tape, tacheometer, total station.

(ii) Vertical Distance.

Level, total station, tacheometer & sextant, Abney level (minor instrument)

(iii) Horizontal Angle

Compass, theodolite, clinometer (minor instrument), total station.

(iv) Vertical Angles.

Theodolite, sextant and total station.

→ Scale of a Map

It is the ratio b/w distance on the map to the distance on the ground.

$$\text{Scale} = \frac{\text{distance on the map}}{\text{distance on the ground.}}$$

1 : 1000 ⇒ 1 unit on map = 1000 units on ground.

(i) Large Scale — 1 cm = 10 m

(ii) Medium Scale. — 1 cm = 100 m

(iii) Small Scale. — 1 cm > = 100 m

(iv) Engineer's Scale — 1 cm = 50 m

→ Error due to Shrinkage of a Map:

Shrinkage factor, $SF = \frac{\text{distance on the map.}}{\text{corresponding dist. on ground}}$

$= \frac{\text{distance during measurement}}{\text{corresponding actual distance.}}$

$\boxed{SF < 1}$

Shrunk scale = Original scale × SF

Shrunk RF = Original RF × SF.

Corrected distance, $CD = \frac{MD}{SF}$

Corrected area, $CA = \frac{MA}{(SF)^2}$

Corrected volume, $CV = \frac{MV}{(SF)^3}$

→ Error due to Wrong Scale:

$$CD = MD \left[\frac{RF \text{ of } WS}{RF \text{ of } CS}\right]$$

$$CA = MA \left[\frac{RF \text{ of } WS}{RF \text{ of } CS}\right]^2$$

$$CV = MV \left[\frac{R.F \text{ of } WS}{RF \text{ of } CS.}\right]^3$$

→ Accuracy:

Degree of accuracy :- It is the ratio between units of error to the units of measured quantity.

Degree of accuracy = 1 in $n$.

ie 1 unit of error in $n$ units of measured value.

→ Precision.

It is closeness to the some other measured quantity.

→ Sources of Errors

(i) Instrumental errors :- when instrument is not caliberated at regular intervals. by permanent adjustments.

(ii) Personal errors :-

(iii) Natural errors.

→ Types of Errors

(i) Mistakes.

(ii) Systematic errors.

(iii) Accidental or Random error.

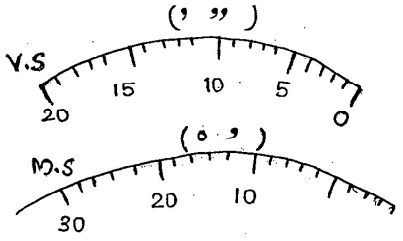
Random errors are directly proportional to square root of 'n'; where n is total no. of observations

$$\boxed{\text{Random error} \propto \sqrt{n}}$$

→ Vernier Scales

$$\text{Least Count, } LC = \frac{S}{n}$$

$$= \frac{1 \text{ MSD}}{\text{No. of VSD's}}$$




* Types of Verniers

(i) Direct Vernier.

'n' divisions of vernier = (n-1) divisions of MS

(ii) ~~Extended~~ Retrogade. Vernier

'n' divisions of vernier = (n+1). divisions of MS

(iii) ~~Retrograde~~ extended. Vernier

'n' division of vernier = (2n-1) . div. of MS

Q.9. Scale = 1 : 1000

1 mm ⇒ 1000 mm.

0.25 mm ⇒ ?

$= \frac{0.25}{1} \times 1000$

$= 250 \text{ mm} = 0.25 \text{ m}$

Q.10. Representative fraction, $RF = \frac{0.5 \text{ cm}}{10 \text{ m}} = \frac{0.5}{10 \times 100} = \frac{1}{2000}$

Q.11 $CD = MD \left( \frac{\text{R.F of WS}}{\text{RF of CS}} \right) = 468 \left( \frac{\frac{1}{2000}}{\frac{1}{4000}} \right)$

$= 936 \text{ m}$

Q.12. 1 MSD = S = 30'

No: of VSD, n = 60

$LS = \frac{30'}{60} = \frac{(30 \times 60)''}{60} = 30''$

Q.13. 1 MSD = S = $\frac{1}{6} \times 60' = 10'$

n = 20

$LC = \frac{(10 \times 60)''}{20} = 30''$

14 $S = 1^\circ = 60'$

For extended vernier,

$$2n - 1 = 11$$

$$n = 6$$

$$\therefore \text{LC} = \frac{60'}{6} = 10'$$

15. $n$ div. of 'V' = $(n+1)$ div. of 'S'

$$10 \text{ V} = 11 \text{ S}$$

16 RF = $1/2500$

1 cm = 2500 cm

$\Rightarrow$ 1 cm = 25 m

18. $\text{SF} = \frac{90}{100} = 0.9$.

SRF = Original RF * SF

$$= \frac{1}{1000} * 0.9 = 9 \times 10^{-4}$$

$$= \frac{1}{1111}$$

$\Rightarrow$ 1 : 1111

24. $\text{SRF} = \frac{1}{2500} * \frac{24}{25} = \frac{1}{2604.16}$

$\Rightarrow$ 1 : 2600

25 $\text{SF} = \frac{9}{10} = 0.9$

$\text{CA} = \frac{\text{MA}}{\text{SF}^2} = \frac{81}{(0.9)^2} = 100 \text{ cm}^2$ (on the plan)

CA on the field = $100 \times 10 \times 10 = 10000 \text{ m}^2$ (SCALE 1 cm : 10 m).