SURVEYING

It is the art of determining the relative positions of points on, above or beneath the surface of the earth by means of direct or indirect measurments of distance, direction and elevation.

Objective of surveying:-

- To determine the relative position of object or points.
- To determine angle and distance between diff. objects.
- To prepare a plan or map.
- To solve measurment problems in optimum way.
- Collect and record data on the relative positions of points on the surface of earth.
- Compute area and volume by diff. methods as per requirment and purpose.
- Check accuracy of the work.
- By using survey data, the various engineering works in correct positions.

Principle of Survey

Location of a point by measurement from two points of reference

↓

The relative position of a point to be surveyed should be located by measurement from at least two point of reference, the ~~points~~ positions of which have already been fixed.

Whole to Part

↓

It is always desirable to carry out survey work from whole to part.

When an area is to be surveyed, first a system of control points is to be established covering the whole area with very high precision. Then minor details are located by less precise methods.

Types of survey

(A) On the Basis of Curvature of Earth :-

Plane surveying

↓

Shape of Earth is spherical, Thus the surface is obviously curved, But in Plane surveying, the curvature of Earth is not taken into account.

- A < 250 km²,
- less degree of accuracy.

Geodetic surveying

↓

Curvature of Earth taken into Consideration.

- A > 250 km²
- very High precision & accura

NOTE:-

i) The difference between an arc of length 12km and the corresponding chord is only 1cm.

ii) The sum of spherical triangles about 195 km^2 in area is exceeds 180° by just 1".

(B) Based on instruments used :-

i) Chain survey :- It is simplest method of surveying in which the linear measurments are directly taken in the field. And Angular measurments are not taken.

ii) Compass surveying :- It is used to determine the dirn of survey line.

iii) Plane table surveying :- In this Field work and Plotting is done using a graphical method.

iv) Tacheometric survey :- It is used to measure Hz & vt. distances of relative points are determined without using any sophisticated instruments such as chain, tape etc.

v) Photographic Survey :- It is used to taking photographs from elevated ground stations.

vi) Theodolite Survey :- It is used to measure Horizontal as well as vertical angles.

(C) Based on object of survey :-

i) Engineering Survey :- It is used for the purpose of planning and designing engineering works such as roads, bridges, railways etc.

ii) Military survey :- It is used for determining the different strata points of strategic importance.

iii) Mine survey :- It is used for exploring mineral wealth.

iv) Geological Survey :- It is used for determining different strata in earth's crust.

v) Archeological survey :- It is Carryout to gather information about sites that are important from archeological Considerations and for unearthing relics of antiquity. (Related to Time).

(D) Based on Nature of field :-

i) Land survey:-

a) Topographic survey :- To determine natural features of a country such as valleys, rivers and artificial features such as road, railway, etc.

b) Cadastral survey :- To locate boundries of field, estate.

c) City survey :- To locate premises, streets, watersupply and drainage systems.

ii) Marine or Hydrographic survey :- It is carryout to determine M.S.L. (mean sea level), water spread area, depth of water bodies, velocity of flow in stream etc.

iii) Astronomical survey :- To determine absolute location of any point on the surface of Earth.

iv) Aerial survey :- In this type of survey data about large tracks of land is collected by taking photographs from an aeroplane.

Plans and map :-

A plan is a graphical representation, to some scale, of the features on, near or below the surface of earth as projected on a horizontal plane which represented by plane of the paper on which the plan is drawn.

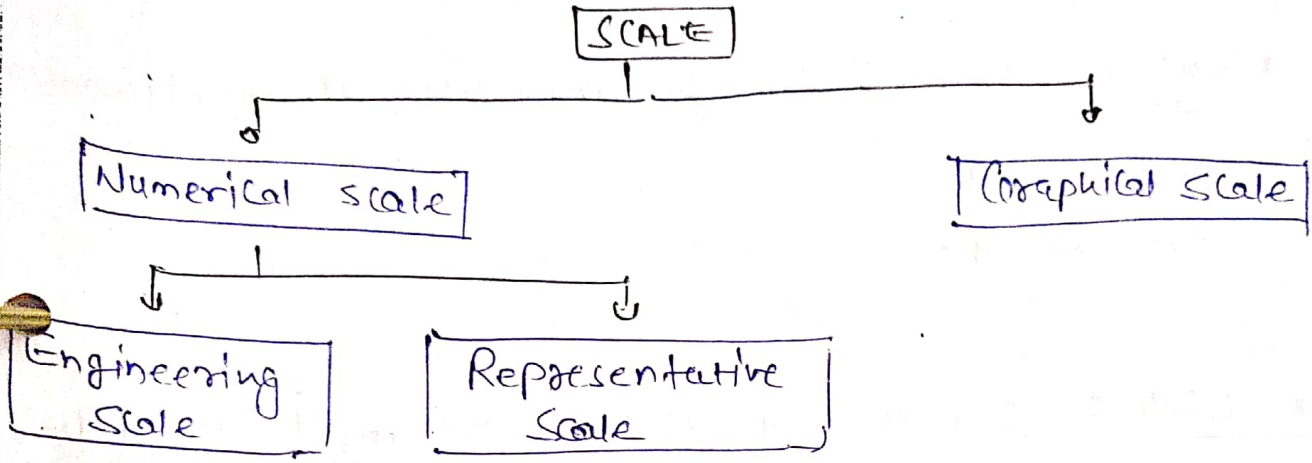
The representation is called a map, if the scale is small while it is called a plan if scale is large.

- On a plan, generally, only horizontal distances and directions are drawn.
- On a orthographic map, however, the vertical distances are also represented by contour lines, hachures or other systems.

Scale :-

Scale is the fixed ratio that every distance on the plan bears with corresponding distance on the ground.

Scale can be represented following methods :-



* Engineering Scale :-

One cm of the plan represents some whole number of meters on the ground such as 1 cm = 100m etc.

* Representative Scale :-

One unit of length on the plan represents some number of same units of length on the ground.

such as $\frac{1}{10000}$ etc.

This ratio of map distance to the corrosponding ground distance is independent of units of measurment and is called R.F.

Ex. 1 cm = 500m

$$R.F. = \frac{1\text{ cm}}{500 \times 100\text{ cm}} = \frac{1}{50,000}$$

* Graphical Scale :- Drawing a line on the map and marking the ground distance directly on it.

Types of Scales :-

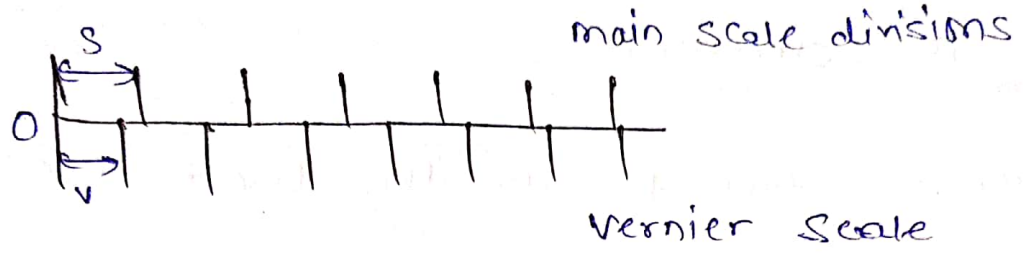
(i) plain scale
(ii) Diagonal scale (Can be measured three dimensio
(iii) vernier scale
(iv) Scale of chords

Vernier Scale :- Divisions of vernier are made slightly shorter or longer. It accurately measures the fractional part of the smallest division on a main scale.

- If gradations of main scale are numbered in one direction only, the vernier used is called single vernier.
- If main scale gradations are marked in both directions, it is known as double vernier.

a) Direct Vernier :-

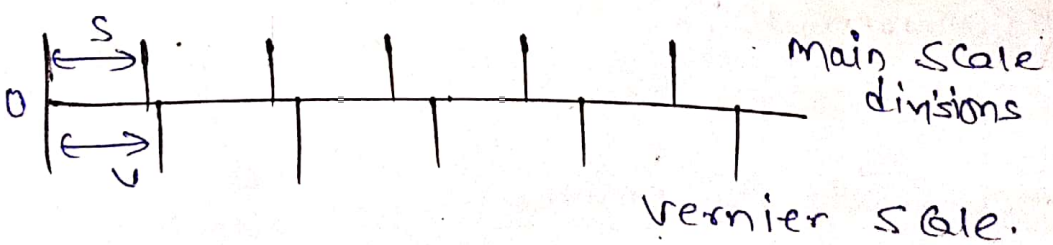
The smallest division on the vernier is shorter than the smallest division on main scale.



$nV = (n-1)S$

$$\text{Least Count} = S - V = S - \left(\frac{n-1}{n}\right)S = \frac{S}{n}$$

b) Retrograde vernier :-



$nV = (n+1)S$

$$\text{Least Count} = V - S = \left(\frac{n+1}{n}\right)S - S = \frac{S}{n}$$

Units of measurments :-

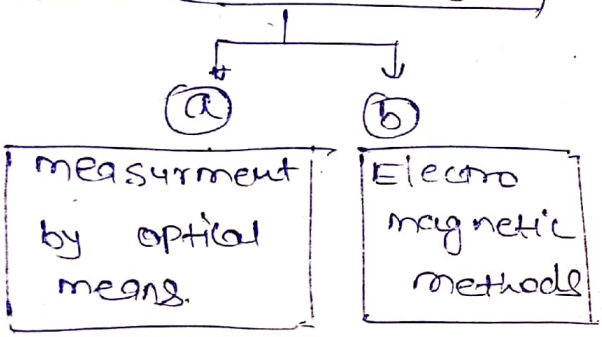
There are two kinds of measurments used in plane surveying -

(i) Linear measurment
(ii) Angular measurment

Linear measurments :-

following are the tools to take the linear measurments

1. Direct measurment.
2. Indirect measurments



(1) Direct measurments :-

a) Pacing
b) measurment with passometer
c) measurment with Pedometer
d) measurment with Odometer
e) measurment with Speedometer.
f) Chaining

(i) Pacing:- Surveyor walks along the line to be measured and counts the number of steps.

ii) measurment with passometer:- A passometer is a watch like instrument which is carried vertically in the pocket of shirt or tied to a leg. It records number of steps taken.

iii) measurment using pedometer:- This instrument similar to passometer but it can record the distance instead of number of steps.

iv) measurment with odometer:- This instrument is attached to the wheel of a cycle or other vehicle. It records the number of revolutions made by the wheel. Knowing the circumference of the wheel, the distance travelled may be found.

v) measurment with speedometer:- Odometer calibrated to give distance directly is called speedometer. This is to be used for particular vehicle only. All the automobiles are provided with speedometers.

vi) Chaining:-

Chaining:- Measurement of distances using chain or tape is termed as chaining.

* Instruments for chaining :-

i) Chain
ii) Tape
iii) Arrows
iv) Pegs
v) Ranging rods
vi) Offset rods
vii) Plasters. Laths & whites
viii) Plumbing bob

i) Chain:- Chain are formed of straight links of galvanized mild steel wire bent into rings at the ends. and joining each other by three small circular or oval wire rings.

The ends of the chain are provided with brass handle at each end. while the length of the chain is measured from the outside of one handle to outside of the other handle.

Types of Chains :- The various types of Chains are-

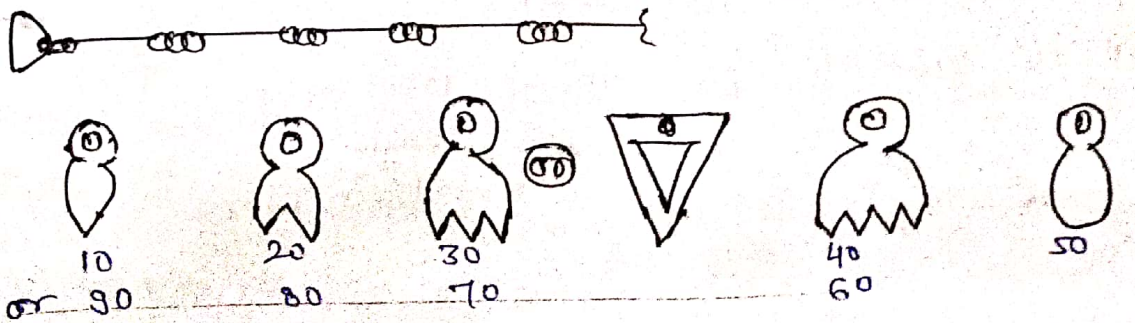
a) Metric Chain :- It is Commonly used for measurement of distances where a very high accuracy is not required.

- Metric chain are available in 5, 10, 20 and 30 meters.
- In one meter length 5 links are present.

1 link = 20cm

Length of chain :-	5m	10m	20m	30m
No. of links :-	25	50	100	150

- To enables the reading tallies are fixed at every meter in 5m & 10m chain. In 20m or 30m chain tallies are fixed at 5m length.



b) Gunter's chain :- (Surveyor's chain) :-

It is 66 ft long & Consists 100 links.

Length of one link = 0.66 ft.

NOTE:-

i) 1 acre = 10 (gunter's chain)^2

= 10 * (66')^2 = 43560 ft^2

ii) 1 mile = 80 gunter's chain = 1.61 km

c) Engineer's chain :-

It is 100 ft long & Consist 100 links.

Length of one link = 1 ft.

d) Revenue Chain :-

It is 33 ft long with 16 links.

length of one link = $2\frac{1}{16}$ ft.

* Suitability of chain :-

- It can be read easily.
- It is suitable for rough use only.
- It can be easily repaired in field.

* Unsuitability of chain:-

- As being heavier, it sags considerably when suspended in air.
- It is suitable for ordinary work only because the length of links gets altered by shortening / lengthing.

NOTE:- The overall length of the chain, when measured at 8 kg pull and checked against a steel tape standardized at 20°C shall be within the following limits.

For 5m chain - (5m ± 3mm)
for 3m chain - (10m ± 3mm)
for 20m chain - (20m ± 5mm)
for 30m chain - (30m ± 8mm)

→ In addition to this every meter length of the chain shall be accurate to ±2mm.

ii) Tape:-

Tapes are used for more accurate measurments.

According to material classification

a) Cloth or Linen tape
b) Metallic tape
c) steel tape
d) Invar tape

a) Cloth or Linen Tape:-

- 12 to 15 mm wide cloth or linen is varnished and graduations are marked.
- They are provided with brass handle at the ends.
- Available in 10m, 20m, 25m and 30m.
- These are light and flexible.

b) Metallic tape:-

- It is made of varnished strip of waterproof linen interwoven with small brass, copper or bronze wires and does not stretch as easily as cloth tape.

c) steel tape:-

- varies in accuracy & quality.

d) Invar Tape:-

- mainly used for high degree of accuracy in linear measurments.
- These are made of alloy of nickel (36%) & steel.

iii) Arrows :-

- An arrow is inserted into the ground after every chain length, measured on the ground.
- Size = 400mm ± 5mm
- Leader holds all the arrows at starting.

iv) Pegs :-

- Wooden pegs are used to mark the position of station or terminal points of survey line.
- 15 cm long tapered at end, pushed by wooden hammer with 4 cm projecting above.

v) Ranging rod :-

- The process of locating a number of points on a long survey line is called ranging.
- This is used to locate intermediate points such these points lie on straight line joining the end stations. Ranging is must before starting the

measurment of a line whose length is more than a chain length such that the measurment is made along a straight line.

- 30 mm in diameter & 2 to 3 m length, Black & white or red & white alternative band.

vi) Offset rod :-

- Length 3m same as ranging rod.
- Having slit at the eye level and hook at the top.
- It is used to align the offset line & measure the short offsets.

vii) Plumb bod :-

- It is used for centring.
- Required to transfer a point on ground.
- Also used for making ranging rod verticle.

Tape Corrections :-

(1) Correction for length or standardization :-

$$C_a = L \cdot \frac{C}{l}$$

Where,

C_a = Correction for absolute length

L = measured length of line

l = Designated length of the Tape

(2) Correction for temperature :-

$$C_t = \alpha (T_m - T_0) L$$

Where, T_m = Temp. at the time of measurment.

T_0 = Standard temperature.

α = Coefficient of thermal expansion.

L = measured length.

if $T_m > T_0 \Rightarrow$ Correction is positive.

& $T_0 > T_m \Rightarrow$ Correction is Negative

(3) Correction for pull or tension :-

$$C_p = \frac{(P-P_0)L}{AE}$$

where,

P = Pull applied

P_0 = Standard pull

A = Cross-section area of tape

E = modulus of elasticity.

(4) Correction due to sag :-

for one Segment.

$$C_s = \frac{W^2L}{24P^2}$$

L = Total length of Tape

If Tape is suspended in n equal segments, then

$C_s = n \cdot C_s$,

$$C_s = \frac{W^2L}{24n^2P^2}$$

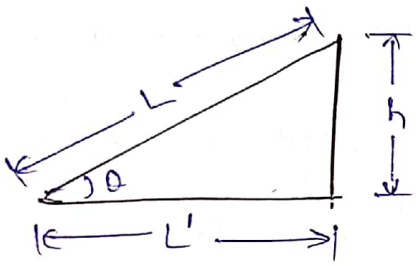
Length of one segment = L/n

Weight of one segment = W/n

* Normal Tension :→ It is the pull which is applied to Tape, equalize the correction due to pull & Correction due to sag.

$$C_p = \frac{(P-P_0)L}{AE} = C_s = \frac{W^2L}{24P^2}$$

(5) Correction due to slope or verticle alignment:-



Correction = L − L' (Subtractive)

$$C = \frac{h^2}{2L}$$

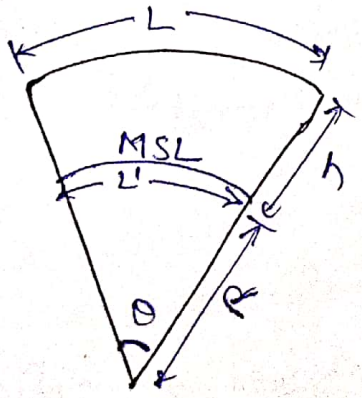
(or) $C = L - L\cos\theta$

$$C = L(1-\cos\theta)$$

(6) Correction for horizontal alignment:-

$$C_h = \frac{h^2}{2L}$$

(7) Correction to mean sea level:-



Correction = L − L'

$= (R+h)\theta - R\theta$

$= h\theta = h\left(\frac{L}{R}\right)$

$$C_{sml} = \frac{Lh}{R}$$ (Subtractive)

Instruments for angular measurements :-

(1.) Theodolite :- It is the most precise instrument for horizontal & verticle angle measurment.

(2) Cross staff :-

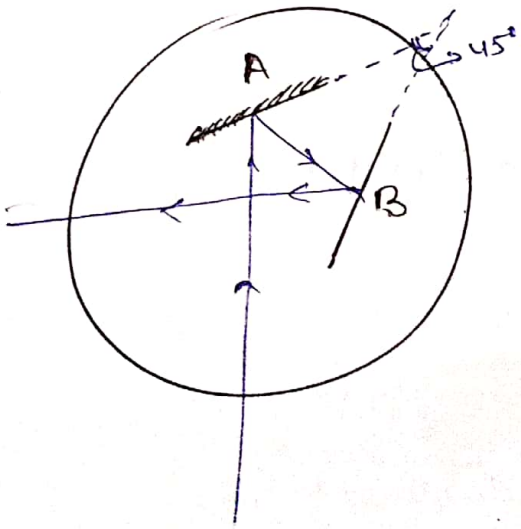
a) Open cross staff :- For 90° angle set up

b) French cross staff - hollow octagonal Box

- verticle sighting slits are cut in each.
- By this 45° & 135° can also be set up.

c) Adjustable cross staff - Any angle can be set.

3) Optical square :-



A ⇒ silvered glass (index glass)

B ⇒ Horizon glass (unsilvered)

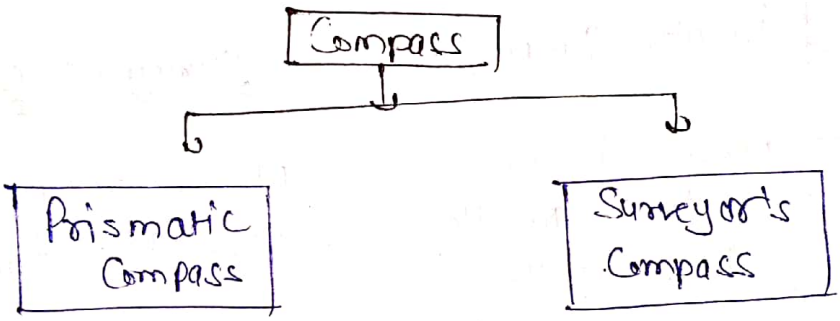
- Its an small pocket instrument, based on optical Principle (two mirrors are placed at 45° inside the box).
- more accurate than cross staff.

4) Prism square :-

5) site square :-

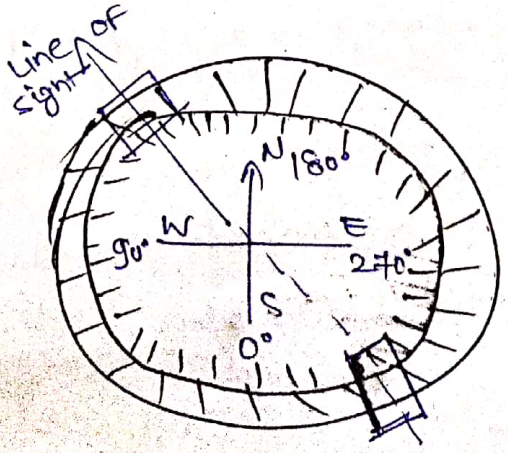
Compass:-

Compass surveying used to measure angle.

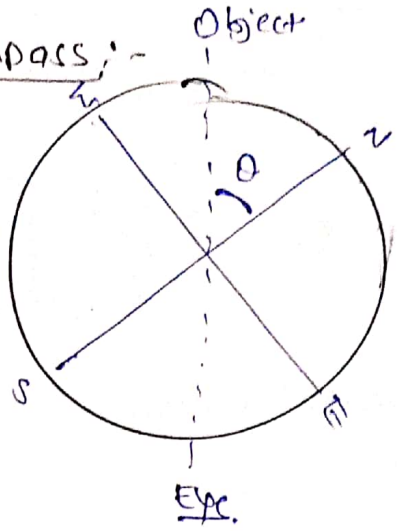


(1) Prismatic Compass :-

Parts:- Box, Needle, Graduated circle, object vane, Eye vane, prism, prism Cap, Glass Cover, Lifting pin, Lifting lever, Break pin, Spring break, mirror, pivot, Light spring, Agate Cap, etc.



② Surveyor's Compass:-



NOW.

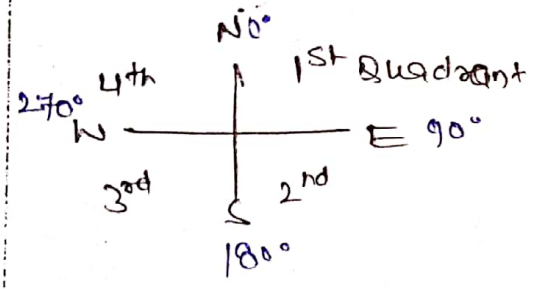
Difference between prismatic & surveyor's Compass:-

	Prismatic Compass	Surveyor's Compass
1. Magnetic needle	The needle is of broad type. Needle does not act as index.	Needle is of edge bar type.
2. Graduated Card	Graduations are marked inverted	Graduations are marked directly.
3. Bearing system	Whole circle Bearing (WCB) (0 to 360°)	Quardental Bearing (QB) (0 to 90°)
4. Prism	Prism at viewing end.	No. Prism, only slit
5. Tripod	Tripod may or may not be provided. It can be used even by holding suitably in hand.	It can't be used without tripod.

Bearing :-

Angle measured with reference meridian is known as bearing.

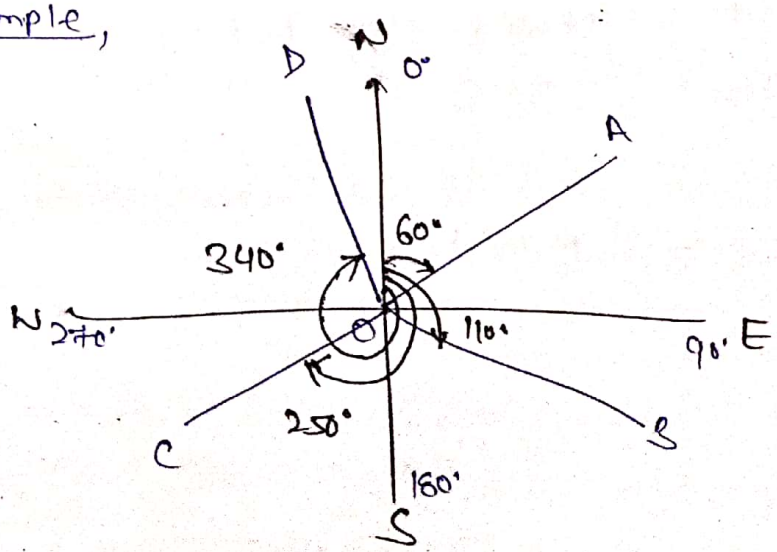
① Whole circle Bearing (W.C.B.) or Azimuthal Bearing :-



→ Angle are always measured from north in clockwise direction.

→ Range [0° to 360°]

Example,

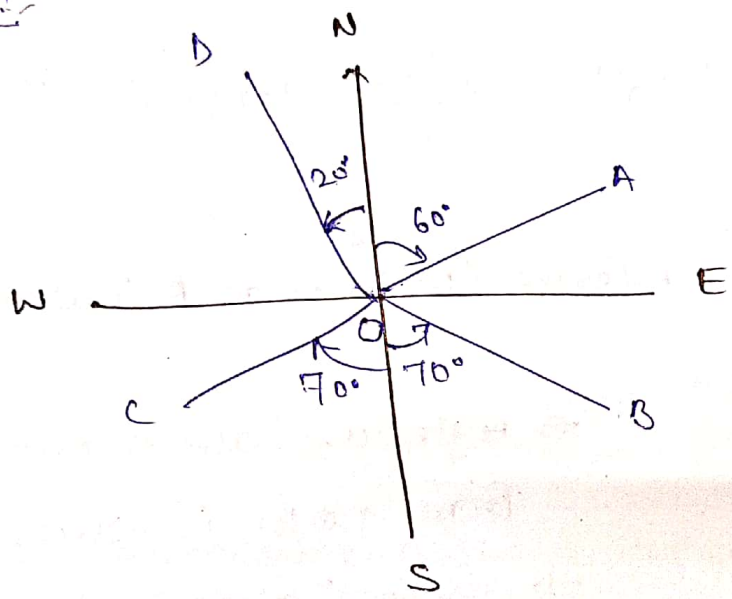


Bearing of OA = 60° (in WCB)
" " OB = 110°
" " OC = 250°
" " OD = 340°

② Quadrantal Bearing (Q.B.) or Reduced Bearing :-

- Angle is measured from nearest either north or south.
- Can be measured in CW or ACW depending on situations.
- Range → [0° to 90°]

Example :-



Bearing of OA = N 60° E (in Q.B)

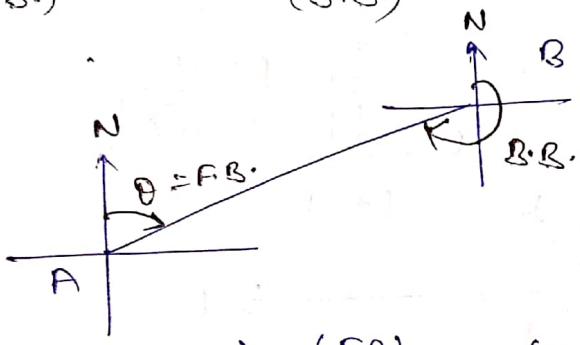
" " OB = S 70° E

" " OC = S 70° W

" " OD = N 20° W

Fore Bearing & Back Bearing :-

(F.B.) (B.B.)



→ F.B. of line AB = θ
→ B.B. of line AB = (180° + θ)
→ F.B. of line BA = (180° + θ)
→ B.B. of line BA = θ

→ $(FB)_{AB} = (BB)_{BA}$

→ $(BB)_{AB} = (FB)_{BA}$

$(FB)_{AB}$ = Angle will be measured from A to B.

$(BB)_{AB}$ = Angle will be measured from B to A.

Example:- Convert the following bearing WCB to QB.

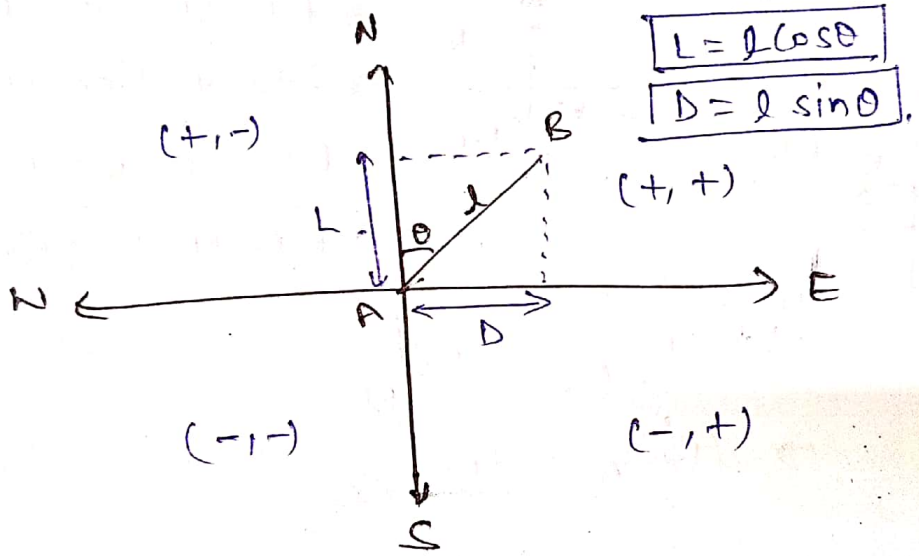
a) 22°30' b) 170°12' c) 221°54' d) 327°20'

	WCB		QB
a)	22° 30'	→	N 22°30' E
b)	170° 12'	→	S 9°48' E
c)	221° 54'	→	S 41°54' W
d)	327° 20'	→	N 32°40' W

Latitude & Departure of a line
(L) (D)

→ Latitude is Coordinate length measured parallel to an assumed meridian direction.

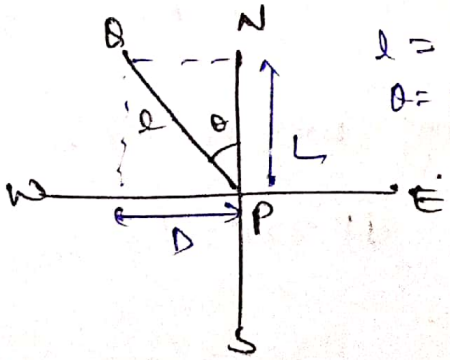
→ Departure of the survey line may be defined as Coordinate length measured at right angle to the meridian direction.



$L = l\cos\theta$

$D = l\sin\theta$.

Example :- Find the latitude & Departure for line PQ.



$l = 10m$

$\theta = 30°$

$D = -L\sin\theta$

$D = -10\sin 30° = -5m$

$L = +L\cos\theta$

$L = 10\cos 30° = 8.66m$

$(L, D) = (8.66, -5)\,m$

Total Station :-

- It is designed for measuring distances, horizontal and vertical angles and elevations in topographic and geodetic work, tacheometric survey.
- The measurment results can be recorded into the internal memory and transferred to a personal Computer interface.
- The Basic properties are speed and accuracy. High efficiency electronic tacheometers are intended for the decision.
- Angle & distances are measured from total station to points under survey, and the Co-ordinates (x, y, & z or Northing, easting & Elevation) of surveyed points relative to the total station position are Calculated using trigonometry and triangulation.
- Data can be downloaded from the total station to a Computer and application software used to Compute results and generate a map of the surveyed area.

Total station is an instrument which consists of the following :-

i) Distance measuring instrument (EDM)

ii) Angle measuring instrument (Theodolite)

iii) A simple microprocessor.

Levelling :- Comparision of heights on Earth Surface.

Object of Levelling is -

i) To find the elevation of the given points with respect to a given or assumed datum.

ii) To establish points at a given elevation or at different elevations w.r.t. assumed datum.

⇒ Levelling deals with measurment in a vertical plane.

Important terms in levelling :-

- **Level surface :-** Surface parallel to mean Spheroidal Surface of earth. e.g. surface of still lake etc.
- **Level Line :-** Line laying in level surface. It is normal to the plumb line at all points.

- **Horizontal plane :-** Plane tangential to level surface at that point.
  It is perpendicular to direction of gravity (plumb line).
- **Vertical line :-** line normal to the level surface.
- **Horizontal line :-** a line laying in the horizontal plane.
- **Vertical plane :-** It is a plane containing a vertical line.
- **Vertical angle :-** Angle b/w two intersecting lines in vertical plane.
- **Datum surface or line :-** Arbitary assumed level which vertical distance measured in india the datum adopted for G.T.S. bench mark is the mean sea level at mumbai.
- **Elevation :-** vertical distance of a point above datum.
- **Bench mark :-** Fixed reference point.

* Line of Collimination :- (Line of sight) :-

→ Line joining the intersection of cross hairs of the optical centre of the object glass.

* Axis of Telescope :- Line joining the optical centre of object glass to the centre of eye piece.

* Fore sight :- Staff reading on a point whose elevation is to be determined or on a change point.

* Intermediate sight :- It is any other staff reading taken on a point of unknown elevation from the same setup of the level.

* Change point :- It is a point denoting the shifting of level. It is a point on which is the fore and back sights are taken.

* Station :- It is a point whose elevation is to be determined.

→ It is a point where staff is held not the point where they leveled is set up.

* Height of instrument :- It is the elevation of the Plane of Collimination when the instrument is Correctly leveled.

* Instruments used in levelling :-

To determine elevation of points two instruments are required :-

1. Level
2. A levelling staff.

① Level :- It is an instrument giving Horizontal line of sight & magnifying the reading far away from it. It consists of following 4 parts.

i) levelling head
ii) ~~tripod~~ Tripod
iii) Telescope
iv) Bubble tube

* Types of level :-

① Dumpy level
② Y level
③ Cole's reversible level
④ Automatic level

(2) Levelling staff:- It is a straight rectangular rod having graduations. The foot of the staff representing 0 reading. During levelling staff is held vertical at the point & the level horizontal sight is taken.

Methods of Levelling :-

i) Barometric levelling :-

→ Difference in elevation between two points is proportional to the difference in atmospheric pressure at these points.

ii) Trignometric levelling (Indirect levelling) :-

→ Elevation of points are computed from the vertical angles and horizontal distance measured in the field.

iii) Spot levelling (Direct levelling) :-

→ The vertical distance w.r.t. a horizontal line may be used to determine the relative difference in elevation between two adjacent points.

Contour maps:-

→ Contour line is which imaginary line that connect the same or equal elevation points.

→ It must close, not necessary in the limits of plan.

→ widely spaced Contour line indicates flat surface.

→ Closely spaced Contour line indicates steep slope.

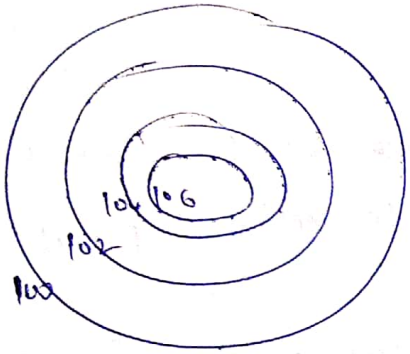
→ Equal spaced Contour line indicates uniform slope.

→ Irregular Contour line indicate uneven surface.

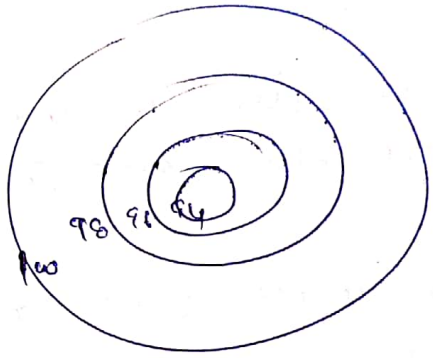
→ Concentric closed Contour with decreasing values towards centre indicates a pond. & increasing towards centre indicate hill.

↳ Contour line do not cross each other except in case of overhanging cliff.

↳ Contour lines are same in case of vertical cliff



Hill



Pond

TAPE CORRECTIONS

Q1 A steel tape 20m long standardised at 55°F with a pull of 10kg was used for measuring a base line. Find the correction per tape length, if the temperature at the time of measurement was 80°F and the pull exerted was 16 kg. wt. of 1 cubic cm of steel = 7.86g, wt of tape = 0.8kg, E = 2.109×10^6 kg/cm^2, Coeff. of expansion of tape per 1°F = 6.2×10^{-6}

Soln Correction for temperature = $20 \times 6.2 \times 10^{-6}(80-55)$

$= L.\alpha.(T_m - T_o)$

$= 0.0031\ m$

Correction for pull $= \frac{(P-P_o)}{AE} L$

Now, wt. of tape = $\underbrace{A \times (Lx)}_{\text{Vol}^n} \times \underbrace{(7.86 \times 10^{-3} kg)}_{\text{weight}}$

$0.8\ kg = A.(20 \times 100\ cm).(7.86 \times 10^{-3}\ kg)$

$\Rightarrow \quad A = 0.051\ cm^2$

so Correction $= \frac{(16-10) \times 20}{(0.055 \times 2.109 \times 10^6)}$

$= 0.00112\ m$

Correction for sag $= \frac{LW}{24P^2} = \frac{20 \times 0.8}{24 \times (16)^2}$

$= 0.00208\ m$

Q2 Calculate the sag correction for a 30m steel chain under a pull of 100N in three equal spans of 10m each. Weight of one cubic cm of steel = 0.078 N
Area of cross section of tape = 0.08 sq.cm

Soln Vol^n of chain per metre run = Area of cross sec $\times$ (1m)

$= 0.08 \times 100 \ cm^3$

$= 8 cm^3$

Weight of chain per metre run = weight $\times$ Vol^n

$= 0.078 \times 8$

$= 0.624 N$

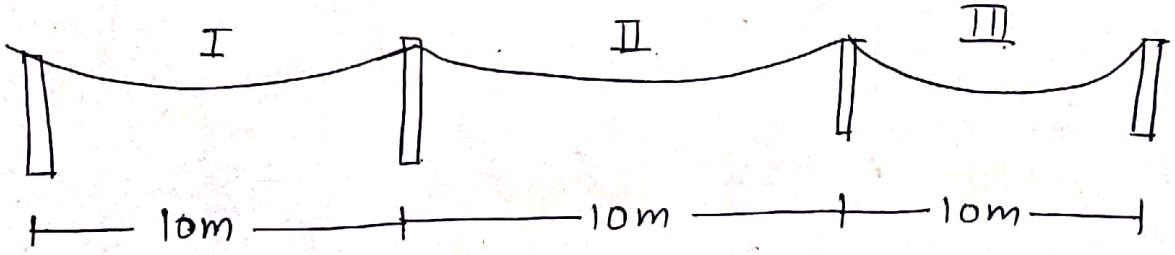
Total weight of chain suspended b/w two supports

$= W = 0.624 \times 10 = 6.24 N$

$$\text{SAG CORRECTION} = \frac{nlW^2}{24P^2}$$

$$= \frac{3 \times 10 \ (6.24)^2}{24 \times (100)^2}$$

$$= 0.00487 m$$



SCALE & RF

Q1 If scale is 1cm = 10m, What is RF? (Representative Factor)

soln: Given 1cm = 10m

$$\text{so } RF = \frac{1cm}{10m} = \frac{1\,cm}{10 \times 100\,cm} = \frac{1}{1000}$$

$$RF = \frac{1}{1000}$$

Q2 If scale is to find out for $RF = \frac{1}{5000}$, write down the scale taken.

soln: Given: $RF = \frac{1}{5000}$

$$RF = \frac{1\,cm}{50 \times 100\,cm.}$$

$$= \frac{1cm}{50\,m}$$

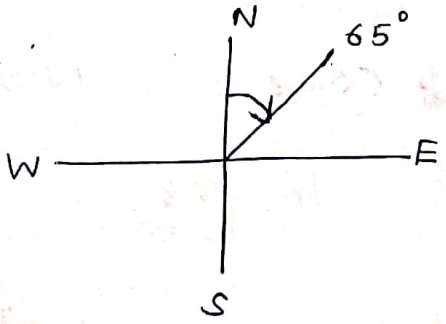
So scale 1cm = 50 m

W.C.B & R.B.

Q1 Convert Reduced Bearing (RB) in to W.C.B.

(i) N 65°E

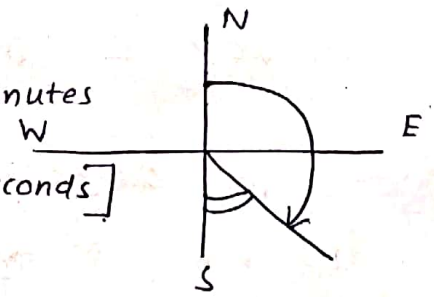
In WCB = 65°



(ii) S 43° 15' E

[we know 1° (degree) = 60' minutes

1' (minute) = 60" seconds]

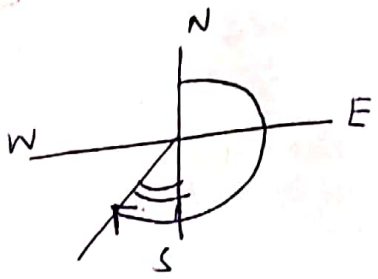


In WCB = 180 − 43° 15'

= (179° 60' − 43° 15')

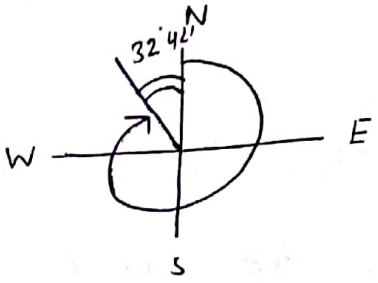
= 136° 45'

(4) (iii) S 52°30'W



In WCB = 180 + 52°30'
= 180 + 52°30'
= 232°30'

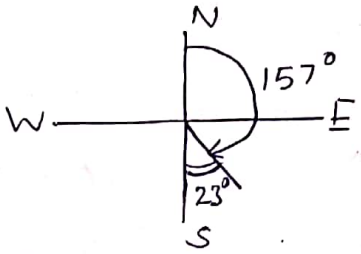
(iv) N 32°42'W



In WCB = ~~180~~ ~~270+32°42'~~
= 360 − 32°42'
= 327°18'

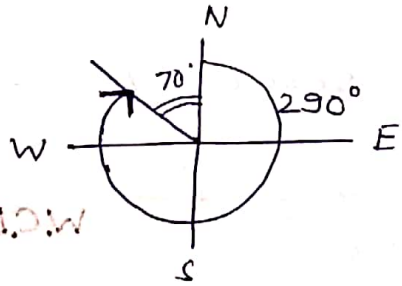
Q2 convert WCB into RB.

(i) ~~S E~~ 157°



In RB = S 23°E
(180 − 23°)

(ii) 290°



In RB = 290°
= (360° − 290°)
= N 70° W

Q3 Convert N 90° E or S 90° E in WCB

sol^n: In WCB = 90°

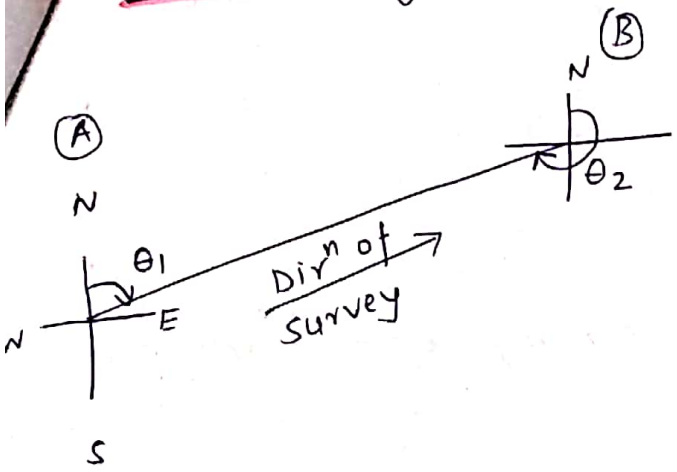
Q4 Convert N 0° W in WCB

sol^n: In WCB = 0° or 360°

Q5 Convert ~~270~~ 270° in RB

sol^n: In RB = 90° W

Fore Bearing and Back Bearing



Back Bearing

$$BB = FB \pm 180$$

If FB > 180 (− sign)

FB < 180 (+ sign)

Fore-bearing of Line AB = θ_1

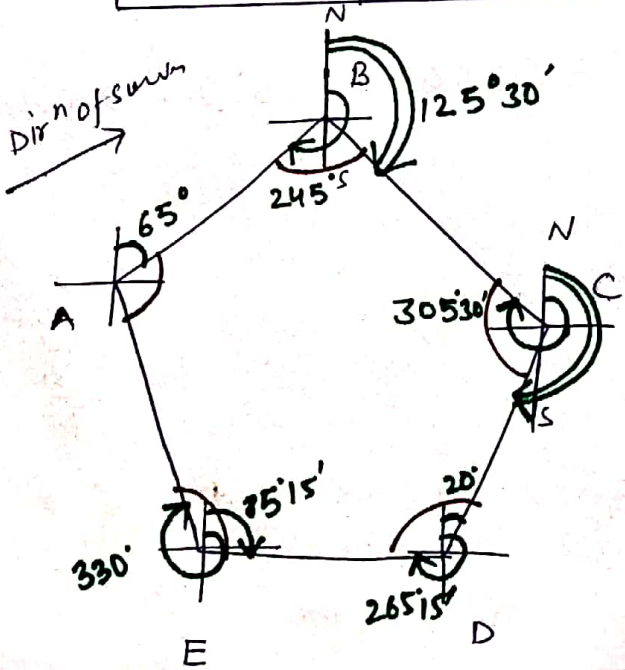
Back bearing of Line AB = θ_2

COMPASS SURVEY

Q1 The following are bearing taken for closed compass traverse. Compute Interior angle.

Given

Line	Forebearing
AB	65° 00′
BC	125° 30′
CD	200° 00′
DE	265° 15′
EA	330° 00′



(6)

Line	FB	BC
AB	65°	245
BC	125°30′	305°30′
CD	200°	20°
DE	265°15′	85°15′
EA	330°	150°

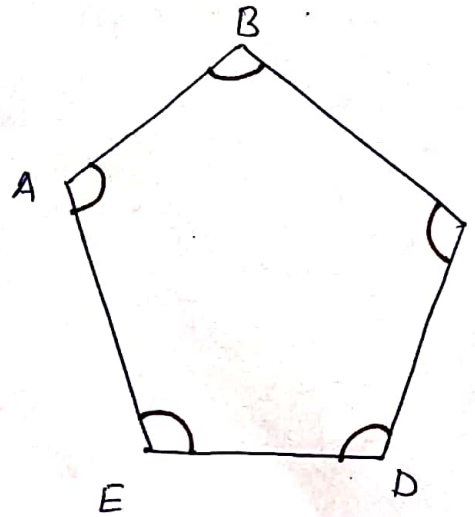
Interior angle – $\angle A = 150 - 65 = 85'$

$\angle B = 245 - 125\,30 = 119°30'$

$\angle C = 305\,30' - 200° = 105°30'$

$\angle D = (360 - 265°15') + 20 = 114'45$

$\angle E = (360 - 330°) + 85°15' = 115'15$



Q2

For given data; Identify which stations are affected by LA (Local attractions). Determine correct bearings.

Line	FB	BB
AB	45°45′	226°10′
BC	96°55′	277°5′
CD	29°45′	209°10′
DE	324°48′	144°48′

Sol^n: Condition for LA : If FB − BB ≠ 180 LA exists.

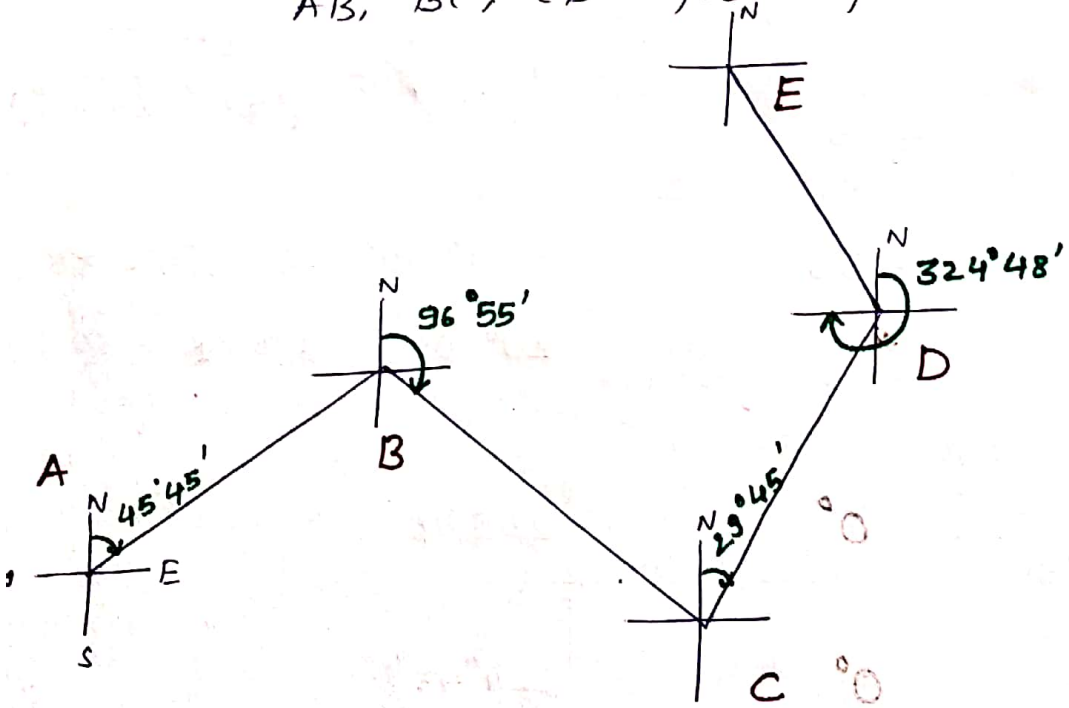
Line	Observed Bearing	Corrections	Corrected B Bearing
AB	45°45′	0°	45°45′ (225°45′ − 180
BA	226°10′	− 25′	225°45′ (226°10′ − 25′)
BC	96°55′	− 25′	96°30′ (276°30′ − 180°)
CB	277°5′	− 35′	276°30′ (∢277°5′ − 35′)
CD	29°45′	* − 35′ (29°45′ − 29°10′)	29°10′ (∢209°10′ − 180°) ∵ BB − FB
DC	209°10′	0°	209°10′
DE	324°48′	0°	324°48′
P			
ED	144°48′	0°	144°48′

* From C, each reading is corrected by − 35′

(8) checking diff. of 180° for LA.

Line	(LA = BB − FB) / LA	Error	Correction
AB	(226°10′ − 45°45′) = 180°25′	+25′	−25′
BC	(277°5′ − 96°55′) = 180°10′	+10′	−10′
CD	(209°10′ − 29°45′) = 179°25′	−35′	+35′
DE	(144°48′ − 324°48′) = 180°	0	0

Here DE is free from LA. so DE will become reference Line.
with the help of DE line we will make AB, BC, CD free from LA.



Since DE is free from LA so DE, ED is error free.

From Result It can be seen that there is LA at B & C points.

Buildings

Components of Building and their functions

Types of building

site plan

selection of site plan for buildings

Layout of building plan

Building Bye-Laws

Concept of Sun light and Ventilation

Basic concept of RCC

Types of Foundation

Plinth Area

Carpet Area

Floor space index