Ketan
D1

70/-

Surveying

Surveying ⇒ Surveying is the brand of the civil engineering which is divide into two parts planning and design of any work (Surveing) be to implement to the planning in actual civil work to be done.

Surveying is divided into three chapters.

1. linear measurement
2. linear & angular measurement
3. levelling

Draw a detail sketch of instrument used in the linear measurements.

1. Matric Chain
2. Arrows
3. Tape
4. Ranging Rod
5. Plumb bob

Surveying is divided in two parts.

1. Plane Surveying
2. Geodetic surveying

[1] Plane surveying :- This is the type of surveying in which plan surface of earth is considered as plane & the spherical shape of earth is neglected. All triangles formed by survey lines are considered as plane triangles.

[2] Geodetic surveying :- Is the type of surveying actule shape of earth is considered as survey lines are curved lines & tranges are spherical tranges.

Classification of Surveying :-

[1] Classification based on nature of field surveying

In this first stage (1) land surveying is
(i) Tropographical surveying

⇒ This consist of horizontal & vertical location of certain points by linear & Angles measurement and is made to determine the natural features of a country such as rivers, hills etc.

[ii] Hydrographic surveying [Marine surveying] :-
which deals bodies of waters for purpose of navigation water supply, determination of mean sea level.

[iii] Astronomical surveying :-
In this are determine the absolute location or direction of any line on the surface of earth. These observations are made with reference to heavenly bodies such as Sun & stars.

[2] Classification based on object of surveying:-

(i) Engineering surveying :- In this roads, - -

(ii) Military surveying :-

(iii) Mines surveying

(iv) Geological surveying

[3] Classification based on instrument used :-

[1] Chain survey

(ii) Theodolite survey
(iii) Chain & compas survey
(iv) Triangulation survey
(v) plane table survey
(vi) photographical survey
(vii) Arial survey

2nd ★ Principals of surveying :-

(i) Working from whole to part.

(ii) To fixed a point atleast ~~three~~ two reference distance are requires from the present points in the fields.

★ Sources of errors :-

[i] Instrumental errors
[ii] Personal errors
[iii] Nautral errors

Types of errors :-

[i] errors by mistake

[ii] Systematic error. (cumulative Errors)
[iii] accidental errors (compensating error; some time +ive or -ive

★ linear measurements:-

There are various methods of linears Measurements.

[i] Direct Measurement:-

In this distance is measured on ground with the help of chain or tape any other instruments.

[ii] Measurement by optical Means:-

[iii] Electronic Method:-

★ Chaning ⇒ chaining is a terms which is used to denote the measuring distance either with the help of chain or tape & it is the most good method Method to making the direct measurement.

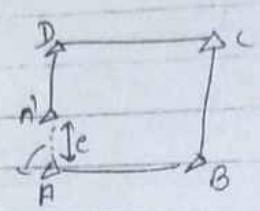
Instrument used for the chaining

[1] Chain or tape [2] Arrows [3] Ranging Rod
[4] Plumb bob [5] Peg

Chain traversing

Traversing of two types

[1] Open Traverse [2] Close Traverse



closing error

⇒ Distance of object from the chain is called - -

Ranging of two types :-

[1] Direct Ranging
[2] Indirect Ranging

⇒ Indirect Ranging is also called Reciprocal Ranging.

* errors in chaining ⇒ [i] Incorrect length of chain or tape.

It is to be sometime +ve and -ve.

[ii] Bed Ranjing :-

[iii] ~~Sag~~ Sag in the Chain

⇒ When the ground ~~the~~ is uneven is always - - -

(iv) Veriation in temp.

⇒ The chain is calibrate at a particular temp. but during the working hours temp. is not same Than there will be error in the measurement.

[v] Variation in pull :->

There is standared pull on which ~~chain~~ chain or tape is standardise. If there is difference in that pull while doing the work measurement is not correct. This errors is compensating error.

[vi] Error due to personal mistake :

Tape correction
- [i] Correction for standardisation
- [ii] Correction for slope
- [iii] Correction for bed Ranjing
- [iv] Correction for ~~tap~~ temp.
- (v) correction for pull or tension
- (vi) Correction for sag.

Tape correction :-

[1] Correction for Standarization →

If the absolute length of the tape or wire is not equal to its nominal or designated ~~length~~ length, a correction will have to be applied to the measured length of the line.

If the absolute length of the tape is greater than the nominal or the designated length the measured distance will be too short and the correction will be additive.

If the absolute length of the tape is lesser than the nominal or designated length, the measured distance will be too great and the correction will be subtractive.

Thus, $\boxed{C_a = \frac{L \cdot c}{l}}$ where C_a = ~~measured~~ correction for absolute length

L = measured length of the line
c = correction per tape length
l = designated length of the tape

[2] Correction for Temperature →

If the temperature in the field is more than the temperature at which the tape was standardised, the length of the tape increase,

measured distance become less and the correction is therfore, additive.

Similarly, if the temperature is less, the length of the tape decreases, measured distance becomes more and the correction is negative.

The ~~corr~~ temp. corr. is given by

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

where α = coefficient of thermal expansion

T_m = mean temp. in the field during measurement

T_o = temp. during standardisation of the tape

L = measured length

If $T_m > T_o$ so C_t = +ive

$T_m < T_o$ so C_t = -ive

Corr. I

[3] Correction for pull and Tension →

If the pull applied during measurement is more than the pull at which the tape was standardised, the length of the tape increases, measured distance becomes less, and the correction is positive (+).

Similarly, if the pull is less, the length of the tape decreases, measured distance becomes more and the correction is negative.

If "C_p" is corr. for pull, we have

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

P = Pull applied during measurement (kg) or (N)

P_o = Standard pull (N)

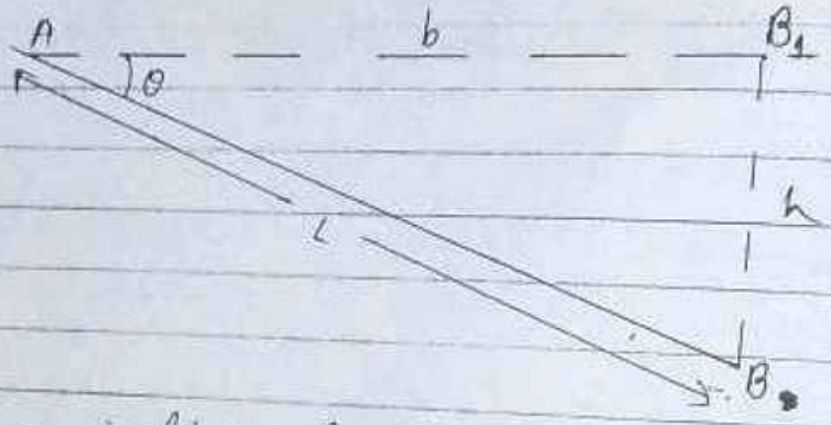
A = Cross-sectional area of the tape (cm^2)

E = Young's Modulus of Elasticity (N/cm^2) or (kg/cm^2)

* If $P > P_o$ ⇒ C_p (+ive)
  $P < P_o$ ⇒ C_p (-ive)

[4] Correction for Slope or Vertical Alignment →

The distance measured along the slope is always greater than the horizontal distance and hence the corrs. is always subtracitive.



Let→

AB = L = inclined length measured

AB_1 = horizontal length

h = difference in ~~the~~ elevation between the ends

C_v = Slope correction, or corrs. due to vertical alignment

So.

$$C_v = AB - AB_1$$

$$\boxed{C_v = L - \sqrt{L^2 - h^2}}$$

$$C_v = L - L\left(1 - \frac{h^2}{2L^2} - \frac{h^4}{8L^4}\right) = \frac{h^2}{2L} + \frac{h^4}{8L^3} + \cdots$$

The second term may safely be neglected for slopes flatter than about 1 in 2.5

Hence, we get $\boxed{C = \sum \frac{h^2}{2L}}$ (subtractive)

⇒ If the angle (θ) of slope is measured instead of h, the corr. is given by

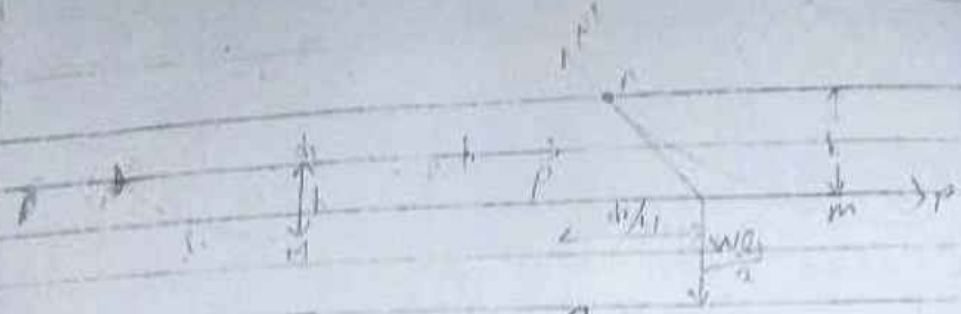
$$\boxed{C_v = L - L\cos\theta = L(1-\cos\theta) = 2L\sin^2\frac{\theta}{2}}$$

$$C_v = 2L\sin^2\frac{\theta}{2}$$

[5] Correction for Sag ⇒

When the tape is streched on supports between two points, it takes the form of a horizontal catenary. The horizontal distance will be less than the distance along the curve. The difference between horizontal distance and the measured length along catenary is called the Sag correction.

For the purpose of determining the correction the curve may be assumed assumed to be a parabola.



$$l_1 = d_1\left[1 + \frac{8}{3}\left(\frac{h}{d_1}\right)^2\right]$$

Hence

$$C_{s1} = d_1 - l_1 = -\frac{8}{3}\frac{h^2}{d_1}$$

l_1 = length of the tape (in meters) suspended between A and B

M = centre of the tape

h = vertical sag of the tape at its centre

w = weight of the tape per unit length (N/m)

C_{s1} = Sag correction in meters for the length l_1

C_s = Sag corr. in meters per tape length l

$$C_s = \frac{l_1 (wl_1)^2}{24 P^2}$$

w = wt. of Tape

l_1 = measured distance b/w supports

P =

★ ERRORS IN CHAINING

1. Bad Ranging → If the chain is stretched out of the line, the measured distance will always be more and hence the error will be +ive.

For each and every streach of the chain, the error due to bad ranging will be cumulative and the effect will be too great a result.

2. Sag in chain → (cumulative; +) ⇒ when the chain is stretched above the ground due to ~~under~~ undulations or irregular ground, the chain sags and takes the form of a catenary. The measured distance is, therefore, too ~~st~~ great and the error is cumulative and positive.

3. Variation in Temperature (Cumulative ; ~~+or-~~) ⇒ when due to the rise in the temperature, the length of the chain increases. The measured distance is thus less and ~~the~~ the error becomes negative.

Due to fall in temp., the length decreases. The measured distance is thus more and the error becomes negative.

[4.] Variation in pull (compensating ± or Cumulative + or -)

If the pull applied in straightening the chain or tape is not equal to that of the standard pull at which it was calibrated, its length changes.

[5] Non-Horizontality ⇒ If the chain is not horizontal, the measured distance will always be too great. The error is, therefore, of cumulative character and positive.

[6] Personal Mistakes ⇒ (i) Displacement of arrows ⇒ If an arrow is disturbed from its position either by knocking or by pulling the chain, it may be replaced wrongly. To avoid this, a cross must also be marked on the ground while inserting the arrows.

(ii) Miscounting chain length ⇒ This is a serious blunder but may be avoided if a systematic procedure is adopted to count the number of arrows.

Tape correction ⇒

[6] Correction for horizontal alignment

[a] Bad ranging or misalignment ⇒ If the tape is stretched out of line, measured distance will always be more and hence correction will be negative. The effect of wrong alignment, in which $AB = L$ is the measured length of the line, which is along the wrong alignment which the correct alignment is AC. Let d be the perpendicular deviation

$$L^2 - l^2 = d^2$$

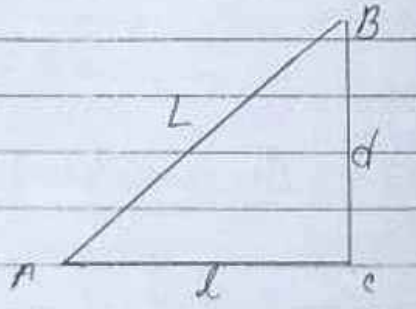
$$(L+l)(L-l) = d^2$$

Assuming $L = l$ and applying it to the first parenthesis

$$2L(L-l) \simeq d^2$$

$$L - l \simeq \frac{d^2}{2L}$$

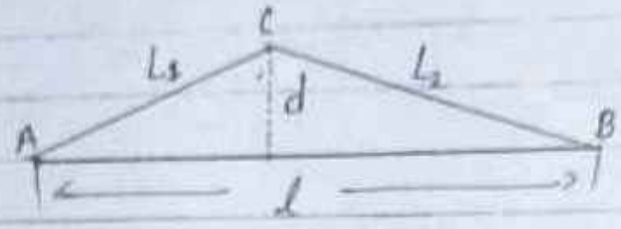
Hence correction $\boxed{C_h = \frac{d^2}{2L}}$



[b] Deformation of the tape in horizontal plane

If the tape is not pulled straight and the length L_1 of the tape is out of the line by amount d, then

$$C_h = \frac{d^2}{2L_1} + \frac{d^2}{2L_2}$$



(iii) Broken base ⇒ Due to some obstructions etc., it may not be possible to set out the base in one continuous straight line. Such a base is then called a broken base.

AC = straight base

AB and BC = two sections of the broken base

β = criterior angle measured at B

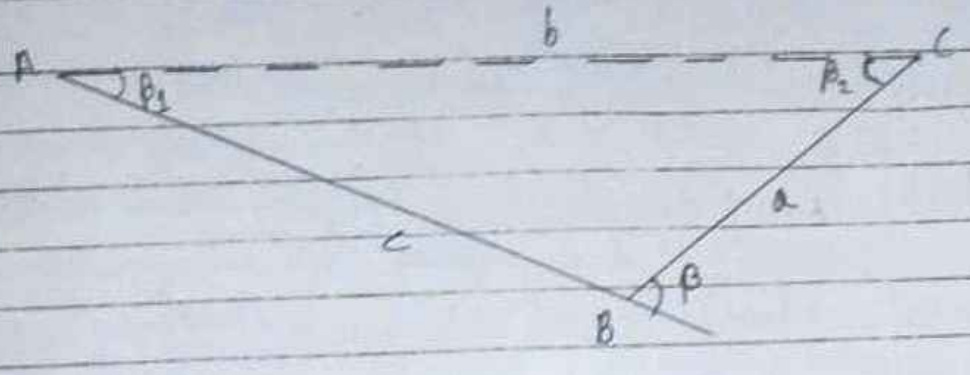
AB = c ; BC = a ; and AC = b

The correction (C_h) for horizontal alignment is given by

$$C_h = (a+c) - b$$

The length b is given by the ~~sine~~ Sine Rule

$$b^2 = a^2 + c^2 + 2ac\cos\beta$$



$$C_h = \frac{ac\beta^2 \sin^2 1'}{(a+c)+b}$$

$$C_h = \frac{ac\beta^2 \sin^2 1'}{2(a+c)}$$

$\therefore \frac{1}{2}\sin^2 1' = 4.2308 \times 10^{-8}$

$$C_h = \frac{ac\beta^2}{(a+c)} \times 4.2308 \times 10^{-8}$$

Ranging

(i) Direct Ranging ⇒ Direct ranging is done when the two ends of the survey lines are intervisible. In such cases, ranging can either be done by eye or through some optical instruments such as a line ranger or a theodolite

Ranging by eye ⇒

Let A and B be the two points at the ends of a survey line. One ranging rod is erected at the point B while the surveyor stands with another ranging rod at point A, holding the rod at about half metre length. The assistant then goes with another ranging rod and establishes the rod at a point approximately in the line with AB at a distance not greater than one chain length from A.

The surveyor at A then ~~sings~~ signals the assistant to move transverse to the chain line, till he is in line with A and B.

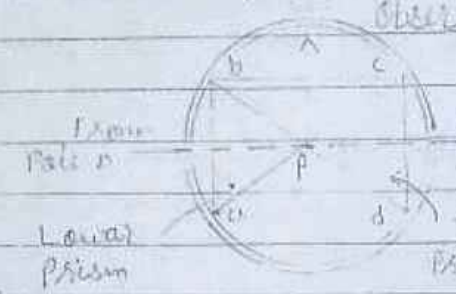
Similarly, other intermediate points can be established. The code of signals used for this purpose is given in the below

Code of Signals for Ranging

S.No.	Signal by the Surveyor	Action by the assistant
1.	Rapid sweep with right hand	Move considerably to the right
2.	Slow sweep with right hand	Move slowly to the right
3.	Right arm extended	Continue to move to the right
4.	Right arm up and moved to the right	Plumb the rod to the right
5.	Rapid sweep with left hand	move considerably to the left.
6.	Slow sweep with left hand	Move slowly to the left
7.	Left arm extended	continue to move to the left
8.	Left arm up and moved to the left	plumb the rod to the left
9.	Both hands above head and then brought down	Correct
10	Both arm extended forward horizontally and the hands depressed briskly	Fix the rod

★ Ranging by line Ranger ⇒

A line ranger consists of either two plane mirrors or two right angled isosceles prisms placed one above the other. ~~as shown~~. The diagonals of the two prisms are silvered so as to reflect the incidental rays. A handle with a hook is provided at the bottom to hold the instrument in hand to tranfer the point on the ground with the help of plumb-bob.



★ Adjustment of Line Ranger: One of the mirrors or prisms is commonly made adjustable.

To test the perpendicularity between the reflecting surfaces, three poles are ranged very accurately with the help of theodolite. The line ranger is held over the middle pole. The instrument will be in perfect adjustment if the images of the two end poles appear in ~~exact~~ exact coincidence. If not, they are made to do so. turning the moveable prism by means of the adjusting screw.

(iii) Indirect or Reciprocal Ranging :-

Indirect or Reciprocal ranging is resorted to when both the ends of the survey line are not intervisible either due to high intervening ground or due to long distance between them.

In such a case, ranging is done indirectly by selecting two intermediate points M_1 and N_1 very near to the chain line (by judgement) in such a way that from M_1 both N_1 and B are visible and from N_1, both M_1 and A are visible.

* Lining and marking:- The follower holds the zero end of the chain at the terminal point while the leader proceeds forwards with the other end in one hand and a set of 10 arrows and a ranging rod in the other hand. When he is approximately one chain length away, the follower directs him to fix his rod in line with the terminal pole. When the point is ranged, the leader makes a mark on the ground holds the handle with both the hands and pulls the chain so that it becomes straight between the terminal point and the point fixed.

Little jerks may be given for this purpose but the pull applied must be just sufficient to make the chain straight in line.

The leader the puts an arrow at the end of the chain, swings the chain slightly out of the line and proceeds further with the handle in one hand and the rest of the arrows and ranging rod in the other hand. The follower also takes the end handle in one hand and a ranging rod in the other hand, follows the leader till the leader has approximately travelled one chain length.

★ Error Due To Incorrect Chain :-

If the length of the chain used in measuring length of the line is not equal to the true length of the designated length, the measured length of the line will not be correct and suitable correction will have to be applied. If the chain is too long, the measured distance will be less.

The error will, therefore, be negative and the correction is positive.

Similarly, if the chain is too short the measured distance will be more, the error will positive and the correction will be negative.

Let L = True or designated length of the chain or tape.

L' = Incorrect length of the chain or tape used

(i) Correction to measured ~~length~~ length :-

Let l' = measured length of the line

l = actual or true length of the line

Then, $\boxed{\text{true length of line} = \text{measured length of line} \times \frac{L'}{L}}$

$$\boxed{l = l'\left(\frac{L'}{L}\right)}$$

(ii) Correction of area :-

A' = measured area of the ground
A = actual or true area of the ground

Then,

True area = measured area $\times \left(\frac{L'}{L}\right)^2$

$$A = A'\left(\frac{L'}{L}\right)^2$$

$$\frac{L'}{L} = \frac{L+\Delta L}{L} = 1 + \frac{\Delta L}{L}$$

ΔL = error in length of chain

$$\frac{\Delta L}{L} = e$$

$$A = \left(\frac{L'}{L}\right)^2 \times A' = (1+e)^2 \times A'$$

$\therefore (1+e)^2 = 1 + 2e + e^2 \approx 1 + 2e$, if "e" is small

$$\boxed{A = (1+2e) \times A'}$$

(iii) Correction to volume :-

V' = measured or computed volume
V = actual or true volume

Then, true volume = measured volume $\times \left(\frac{L'}{L}\right)^3$

$$V = V'\left(\frac{L'}{L}\right)^3$$

$$\therefore \frac{L'}{L} = \frac{L+\Delta L}{L} = 1 + \frac{\Delta L}{L}$$

$$\Rightarrow \frac{\Delta L}{L} = e$$

$$V = \left(\frac{L'}{L}\right)^3 V'$$

$$V = (1+e)^3 V'$$

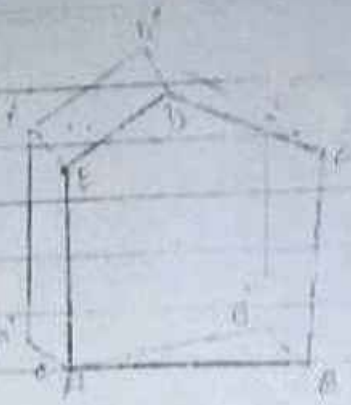
$$\therefore (1+e)^3 = 1 + e^3 + 3e + 3e^2 \approx (1+3e)$$

if e is small

$$\boxed{V = (1+3e)V'}$$

★ Graphical Method ⇒ For rough survey, such as a compass traverse, the Bowditch rule may be applied graphically without doing theoretical calculations. Thus, according to the graphical method, it is necessary to calculate latitudes and departures etc.

However, before plotting the traverse directly from the field notes, the angles or bearings may be adjusted to satisfy the geometric conditions of the traverse.



(a)

Thus, polygon AB'C'D'E'A' represents an unbalanced traverse having a closing error equal to A'A since the first point A and the last point A' are not coinciding.

The total closing error AA' is distributed linearly to all the sides in proporation to their length ~~by a graphical construction shown~~ by a graphical construction shown, AB', B'c', c'd' etc. represent the length of the sides of the traverse either to the same scale as that of Fig (a) or to a reduced scale.

The ordinate aA' is made equal to the closing error A'A. By constructing similar tringles, ~~the~~ the corresponding errors bB', cC', dD', eE' are found.

Lines EE', DD', cc', BB' are drawn parallel to the closing error AA' and made equal to eE', dD', cC', bB' respectively.

The polygon ABCDE so obtained represents the adjusted traverse. It should be remembered that the ordinates bB', cC', dD', eE', aA' represents the corresponding errors in magnitude only but not in direction.

Chain Surveying

★ Chain Triangulation ⇒ It is that type of surveying in which only linear measurements are made in the field.
This type of surveying is suitable for surveys of small extent on open ground to secure data for exact description of the boundaries of a piece of land or to take simple details.

To get good results in plotting, the framework should consist of triangles which are as nearly equilateral as possible.

★ Fundamentals of Chain Surveying ⇒

[1] Surveying station ⇒ A survey station, in chain surveying, defined as a point at the beginning and end of a chain line.
There are two types types :-

(i) Main survey stations :- Main survey stations are prominent points, which are connected by survey lines to from the triangles.

(ii) Subsidiary survey stations/ tie stations :-

Subsidiary survey stations are the points selected on the main survey lines, where it necessary to run auxiliary lines to locate the intirior detail such as fences, hedges, building etc.

[3] Survey lines :- Lines joining the survey stations are called survey lines.

(i) Check line :- A check line or a proof line is provided to check the accuracy of the field work and plotting work. It joins apex of a triangle with ~~some~~ some other fixed point on the opposite line.

(ii) Tie lines :- A tie line connects two tie stations In general, a tie line serves two purposes.

[a] It checks the accuracy of the fieldwork and therefore can also act as a check line.

[b] It helps in taking offsets of additional interior detail which are far away from the chain line.

[7] Offset ⇒ An offset is the distance of an object or ground feature measured from a survey line.

By method of offsets, the points of or object is located by measurement of a distance and angle (usually 90°) from a point on the chain line.

When the angle of offset is 90°, it is called Perpendicular offset or Sometimes, simply, offset and when the angle is other than 90°, it is called Oblique offset.

(v) When large areas are involved only chain surveying is not convenient in such cases some short of instruments are required to enable angle and direction of survey lines to be observed.

Instrument used are (i) Surveyor's compass
(ii) Prismatic compass
(iii) Sextant
(iv) Theodolite

* Traverse Survey ⇒ Traversing is the type of survey in which number of connected survey lines from the frame-work of direction & length. Triangles of the survey lines is measured with the help of angle measuring instruments & chain or tape.

* Bearings and Angles : There are 3 types of bearings

⇒ Bearing of a line is its direction relative to a given meridian.

(1) True Meridian ⇒ Is the line passing through north & south poles, intersecting the surface of earth.

* True bearing of a line is the horizontal angle which it makes with the true meridian.

(2) Magnetic Meridian ⇒ Is the direction shown by a freely floating and balanced magnetic needle free from all other attractive forces.

The direction of magnetic meridian can be established with the help of a magnetic compass.

(3) Arbitrary Meridian ⇒ Is any convenient direction towards a permanent and prominent point or signal, such as top of church and top of a chimney.

Bearing measured with respect to arbitrary meridian is arbitrary bearings.

⇒ There are two method to measure bearing

[1] Whole ~~to~~ Circle Bearing method :- In this system, the bearing of a line is measured with magnetic

north (or with south) in clockwise direction.

* Values of bearing varies from 0° to 360°.
(W.C.B) (Prismetic)

[2] Quadrantal Bearing System : (Reduced bearing)

In this system, bearing of the line is measured eastward or westward from north or south, whichever is nearer.

* Fore bearing & Back bearing :- If the bearing of the line is measured from A to B in the forward direction than bearing is called Fore bearing or forward bearing.

⇒ If it is measured in back direction than it is called back bearing.

∴ $\boxed{B.B. = F.B. \pm 180^\circ}$

F.B. > 180° ; use + sign

F.B. < 180° ; use − sign

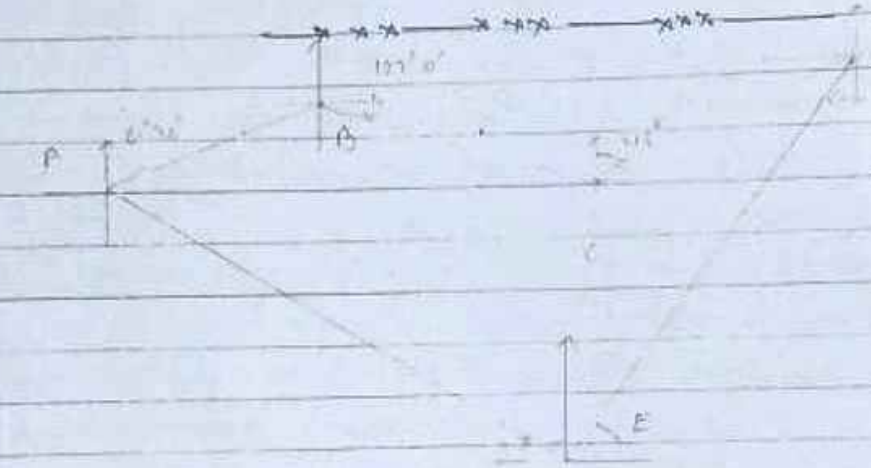
Imp. point ⇒

⇒ use + sign if F.B. is less than 180°.

⇒ use − sign if F.B. is more than 180°.

⇒ F.B. − B.B = 180° there is free from attractive force.

⇒ if F.B. − B.B. ≠ 180° then it is called local attraction.



Included angle = Bearing of previous line − Bearing of next line

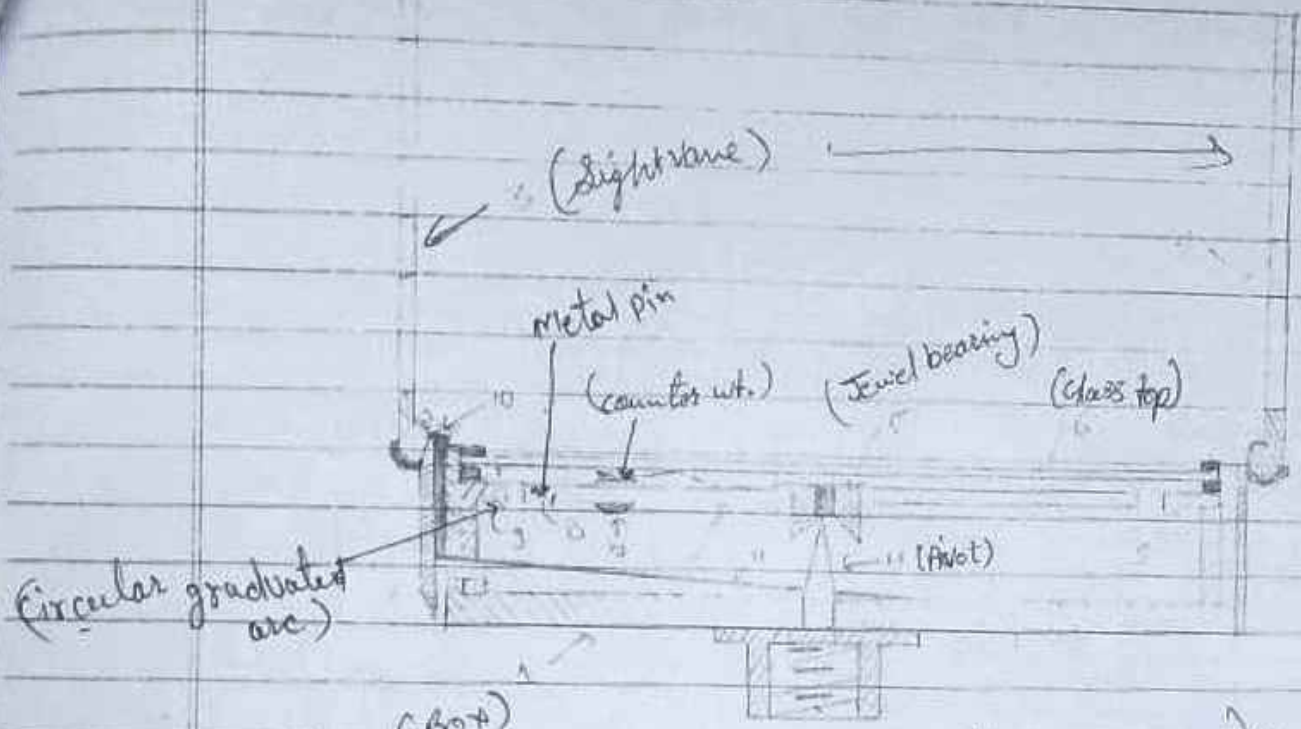
Ex Angle A = Bearing of AE − Bearing of AB

= (300° − 180°) − 60°30'

= 120° − 60°30'

= 59°30'

Ans



(1) Box
(2) Magnetic ~~Compass~~ needle
(3) Sight vanes
(4) Pivat
(5) Jewel bearing
(6) Glass top
(7) Counter weight
(8) Metal pin
(9) Circular graduated arc
(10) Lifting pin
(11) Lifting lever

The Surveyor's Compass

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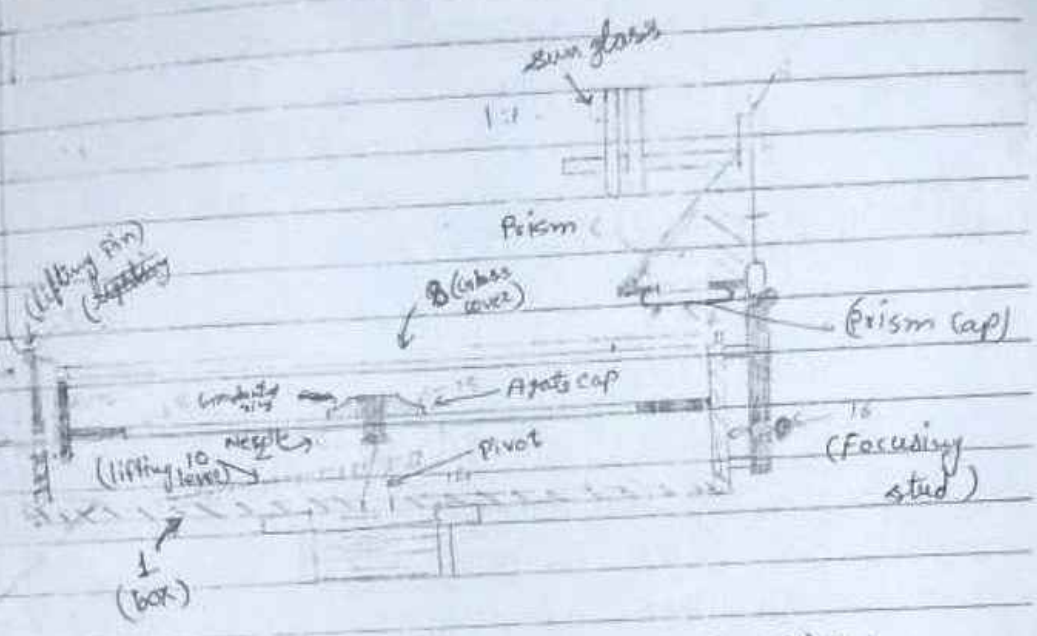

(1) Box
(2) Needle
(3) Graduated Sing
(4) Object vane
(5) Eye vane
(6) Prism
(7) Prism Cap
(8) Glass cover
(9) Lifting Pin
(10) Lifting lever
(11) Brake pin
(12) Spring brake
(13) Mirror
(14) Pivot
(15) Agate cap
(16) Focusing stud
(17) Sun glass

The Prismatic Compass

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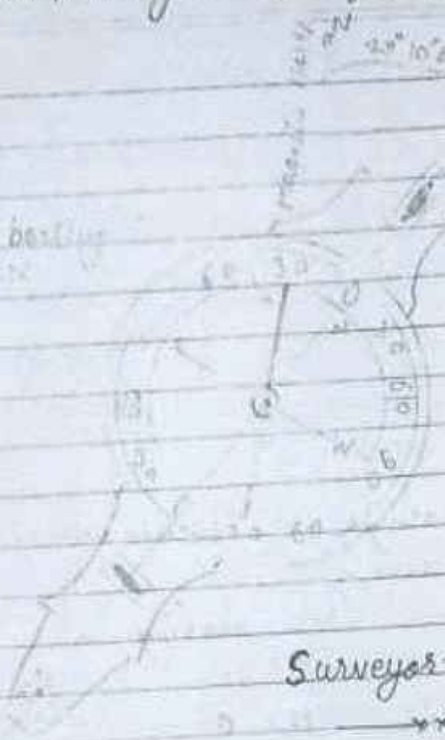
System of Graduations in Prismatic Compass

Local attraction: Local attraction is a term used to denote any influence, such as the above, which prevents the needle from pointing to the magnetic North in a given locality.



Surveyor's Compass (Plan)

* MAGNETIC DECLINATION :-

Magnetic declination at a place is the horizontal angle between the true meridian and the magnetic meridian

If the magnetic meridian is on the right side of declination is said to be eastward and it is positive.
If the magnetic meridian is on the left side the declination is said to be westward and it is negative.

* Isogonic line :- Isogonic line is the line drawn through the points of same declination.

* Agonic line :- Agonic line is the line made up of points having a zero declination.

$(2n-4)\times 90$

Check $(2\times 5-4)\times 90^\circ = 540^\circ$

Determination of True Bearing ⇒

True bearing = magnetic bearing ± declination

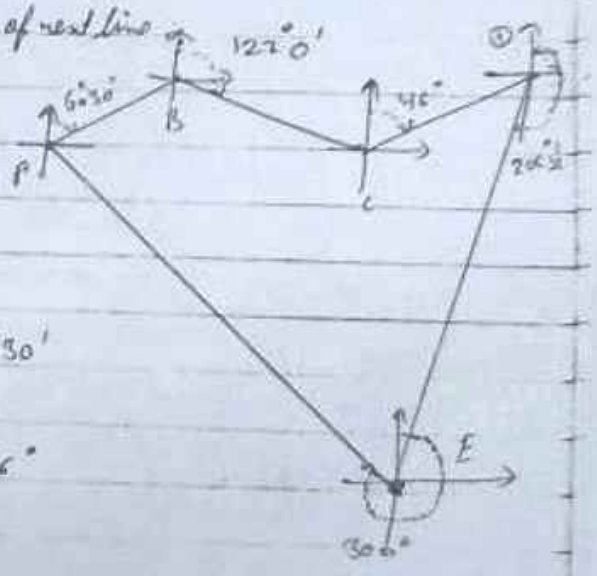
use + sign if declination is eastward.
use - sign if declination is Westward.

Example: The following bearings were observed with a compass. Calculate the interior angles.

Line	Fore Bearing
AB	60° 30'
BC	122° 0'
CD	46° 0'
DE	205° 30'
EA	300° 0'

Entries
B.B. = F.B. ± 180°
F.B. > 180°; + sign
F.B. < 180°; - Sign

Sol. Included angle = Bearing of prev. line − B. of next line



$\angle A$ = Bearing of AE − Bearing of AB
$\angle A = (300^\circ - 180^\circ) - 60^\circ 30' = 59^\circ 30'$

$\angle B$ = Bearing of BA − B. of BC
$= (60^\circ 30' + 180^\circ) - 122^\circ 0' = 118^\circ 30'$

$\angle C$ = Bearing of CB − Bearing of CD
$= (122^\circ + 180^\circ) - 46^\circ = 256^\circ$

$\angle D$ = Bearing DC − Bearing of DE
$= (46^\circ + 180^\circ) - 205^\circ 30' = 20^\circ 30'$

$\angle E$ = Bearing of ED − Bearing EA
$= (205^\circ 30' - 180^\circ) - 300^\circ + 360^\circ = 85^\circ 30'$

Sum = 540°
Check
Tap

Levelling :

Levelling : (Definition) Levelling is a branch of surveying the objective object of which is :

1. to find the elevations of given points with respect to a given or assumed datum, and
2. to establish points at a given elevation or at different elevations with respect to a given or assumed datum.

Level surface : A level surface is defined as a curved surface which at each point is perpendicular to the direction of gravity at the point. The surface of a water still water is a truly level surface

Level Line : A level line is a line lying in a level surface. It is normal to the plumb line at all points.

Horizontal plane : Through a point is a plane tangential to the level surface at that point. It is therefore, perpendicular to the plumb line through the point.

Horizontal line : It is straight line tangential to the level line at a point. It is also perpendicular to the plumb line.

Vertical line :- It is a line normal to the level line at a point. It is commonly considered to be the line defined by a plumb line.

Datum :- It is any surface whose elevations is known to us w.r.t. some assumed surface.

Elevation :- The elevation of a point on or near the surface of the earth is its vertical distance above or below an assumed level surface or datum.

Mean Sea Level :- Mean sea level is the convenient datum and whose elevation given to us.

Bench Mark :- Bench mark is a relatively permanent point of reference whose elevation with respect to some assumed datum is known.

★ Methods of Levelling :-

There are 3 types :

[1] Barometric levelling :- Barometric levelling makes use of the phenomenon that difference in elevation between two points is proportional to the difference in atmospheric pressures at these points.

[2] Trignometric Levelling (Indirect levelling)

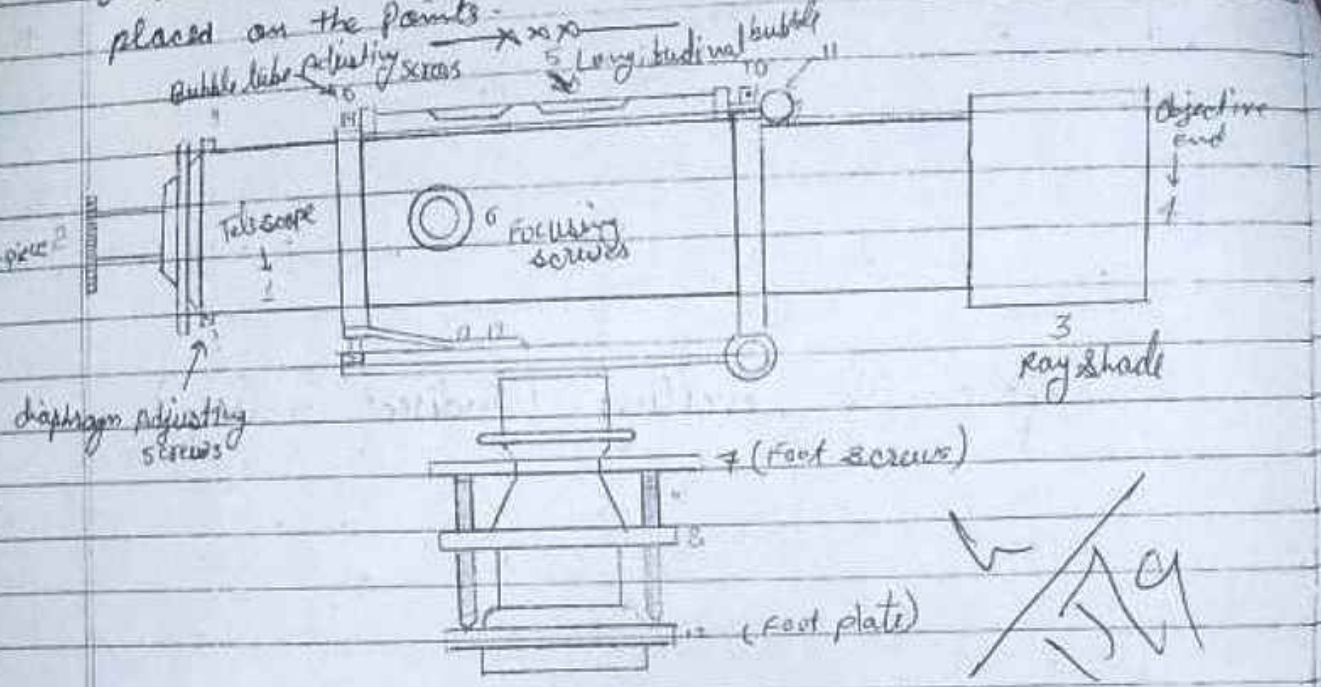
Trignometric or Indirect levelling is the process of levelling in which the elevations of points are computed from the vertical angles and horizontal distances measured in the field, just as the length of any side in any triangle can be computed from proper trignometric relations. In a modified form called Stadia levelling

[3] Spirit Levelling (Direct Levelling) :- It is the process of levelling in which the vertical distances with respect to a horizontal line (perpendicular to the direction of gravity) may be used to determine the relative difference in elevation between two adjacent points. ⇒

(in fact) ⇒ The method is also known as direct levelling and is the one most used by engineers.

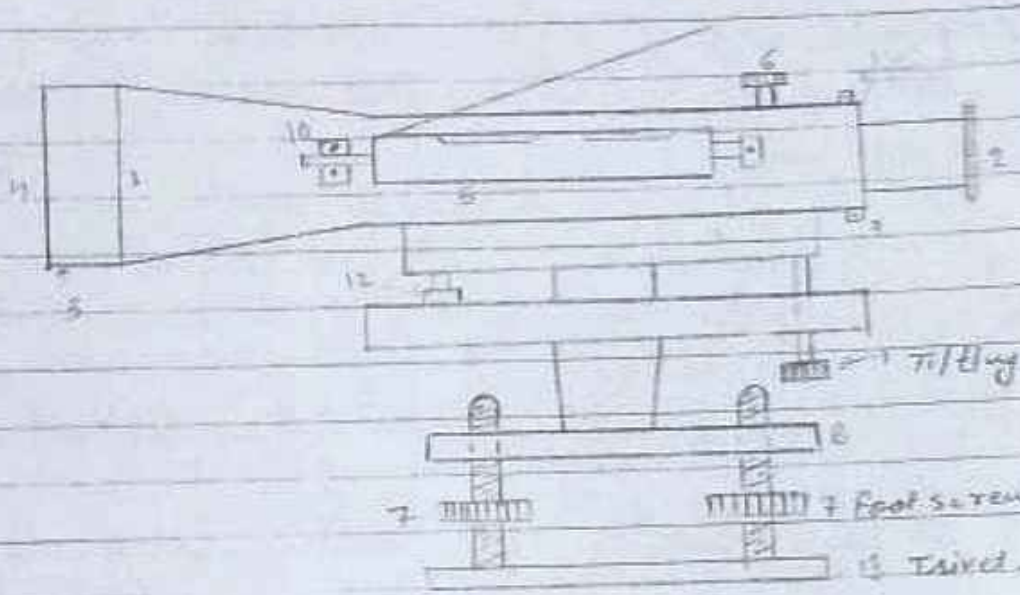
→ A horizontal plane of sight tangent to level surface at any point is readily established by means of a spirit level or a level vial. In spirit levelling, a spirit level and

a sighting device (telescope) are combined and vertical distance are measured by observing on graduated rods placed on the points.



∴ DUMPY LEVEL ∴

1. Telescope
2. Eye-Piece
3. Ray Shade
4. Objective End
5. Longitudinal Bubble
6. Focussing Screws
7. Foot Screws
8. Upper parallel plate (Tribrach)
9. Diaphragm Adjusting Screws
10. Bubble Tube Adjusting screws
11. Transverse Bubble-Tube
12. Foot Plate (Trivet stage)



TILTING LEVEL

1. Telescope
2. Eye-Piece
3. Ray Shade
4. Objective End
5. Level Tube
6. Focusing screws
7. Foot screws
8. Tribrach
9. Diaphragm Adjusting Screws
10. Bubble Tube Fixing Screws
11. Tilting Screws
12. Spring Loaded plunger
13. Trivet stage

★ Levelling Inst.

[1] A level
[2] A levelling staff.

[1] Level ⇒

The purpose of a level is to provide a horizontal line of sight. Essentially, a level consist of the following four parts:-

[a] A telescope to provide line of sight
[b] A level tube to make the line of sight horizontal
[c] A levelling head to bring the bubble in its centre of run
[d] A tripod to support the instrument.

[2] A levelling staff :- A levelling staff is a straight rectangular rod having graduations, the foot of the staff representing zero reading. The purpose of a ~~level~~ levelling staff is to determine the amount by which the station is above or below the line of sight.

Levelling staff devided in two parts:

[1] Self-reading staff
[2] Target staff

* Temporary Adjustments of a level.

[1] Centring / setting up the level :- The operation of setting up includes :-

[a] Fixing the instrument on the stand.

[b] levelling the instrument approximately by leg adjustment. To fix the level to the tripod, the clamp is released, instrument is held in the right-hand and is fixed on the tripod by turning round the lower part with the left hand. The tripod legs are so adjusted that the instrument is at the convenient height and the tribrach is approximately horizontal. Some instruments are also provided with a small circular bubble on the tribrach.

[2] Levelling :- Levelling is done with the help of foot screws and with reference to the plate levels. The purpose of levelling is to make the vertical axis truly vertical.

[3] Elimination of Parallax :- It does 2 parts :-

[i] To bring the cross-hairs is the distinct of your eye.

[ii] Focusing of object by focusing screw.

★ Method of spirit levelling :-

1. Fly / Differential Levelling :- Fly levelling is also called differential levelling, it is the type of levelling in which :-
We find out difference of levels between two points irrespective of horizontal path adopted.

★ Terms and Abbreviations :-

⇒ Back sight :- Back sight is reading taken on that point where elevation is known us.

⇒ Fourth sight (F.S.) :- Fourth sight is that point (Fore) where reading is taken & elevation is unknown to us.

★ **H.I. = R.L of B.M. + B.S.**

where H.S. :) Height of Instrument
R.L. = Reduced level
B.M = Bench Mark
B.S. = Back sight

Turning the telescope to bring into view the rod held on part B, a foresight is taken. Thus

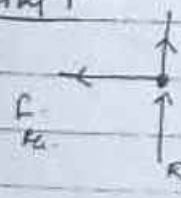
R.L. = H.I. − F.S.

[b] Profile Levelling :- It is the method of direct - levelling the object of which is to determine the elevations of points at measured intervals along a given line in order to obtain a profile of the surface along that line.

[c] Cross - Sectioning ⇒ Cross - sectioning or cross levelling is the process of taking levels on each side of a main line at right angles to that line, in order to determine a vertical cross - section of the surface of the ground, or of underlying strata, or of both.

[d] Reciprocal levelling ⇒ It is the levelling in which the degree of ~~precision~~ required the difference in elevation between two points is accurately determined by two sets of reciprocal observations when it is not possible to set up the level between the two points.

joint F



$\Sigma V = 0$

$R_F = - f_{EF}$

$f_{EF} = - R_F = -110\ KN$

$\Sigma H = 0$

$f_{FG} = 0$

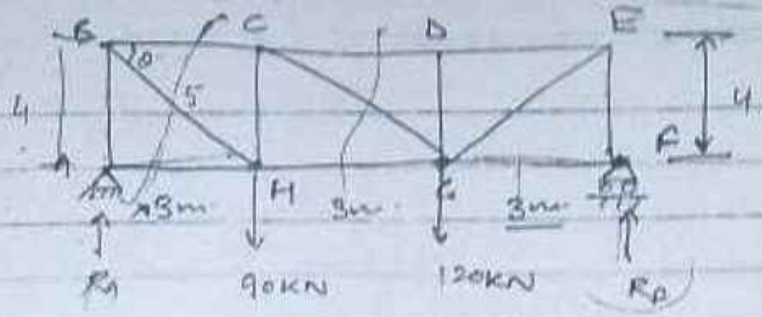
$\Sigma H = 0$

$f_{BC} = f_{BH} \cos\theta$

$f_{BC} = -125 \times \frac{3}{5}$

$= -75$

Method – (1) Method of joint
(2) Method of section



→ Reactions

$\Sigma V = 0$

$R_A + R_F = 90 + 120$ — (1)

$M_A = 0$ anticlock +ve
" -ve.

$R_F \times 9 - 120 \times 6 - 90 \times 3 = 0$

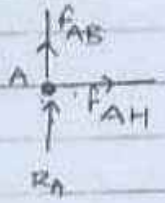
$R_F = \frac{270 + 720}{9} = \frac{990}{9} = 110$ KN.

$R_A = 210 - 110 = 100$ KN.

Tension +ve

→ Member	Force	
AB	−100 (comp)	comp. comp −ve
BC	−75	Comp
CD		
DE		
EF	−110	
FG	0	
GH		
HA	0	
BH	−125	comp.
CH		
CG		
DG		
EG		

joint A



$\Sigma V = 0$

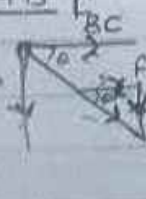
$F_{AB} + R_A = 0$

$F_{AB} = -R_A = -100$

$\Sigma H = 0$

$F_{AH} = 0$

joints



$\Sigma V = 0$

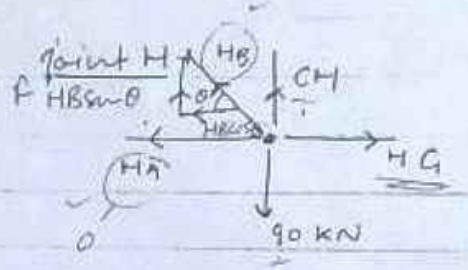
$F_{AB} = F_{BH} \sin\theta$

$-100 = F_{BH} \sin\theta$ →

$F_{BH} = -100 \times \frac{5}{4} = -125$

TRAVERSE SURVEYING

Pg. (16)



$\Sigma V = 0$

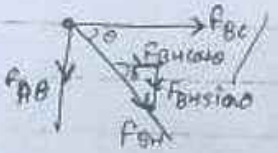
$HB\sin\theta + CH = 90$

$-125 \times \frac{4}{5} + CH = 90$

$-100 + CH = 90$ * Joint B

$CH = 190\,KN$

$\Sigma V = 0$



$f_{AB} + f_{BH}\sin\theta$

$f_{AB} = -f_{BH}\sin\theta$

$-100 = -f_{BH}\frac{4}{5}$

$f_{BH} = \frac{100 \times 5}{4} = +125$

The Compass

Item	Prismatic compass	Surveyor compass
(1) Magnetic Needle	The needle is of 'broad needle' type. The needle does not act as index.	The needle is of 'edge bar' type. The needle acts as the index also.
(2) Graduated Card	(i) The graduated card ring is attached with the needle. The ring does not rotate along with the line of sight.	(i) The graduated card is attached to the box and not to the needle. The card rotates along with the line of sight.
	(ii) The graduations are in W.C.B. System having 0° at South and, 90° at West, 180° at N, 270° at East	(ii) The graduations are in Q.B. System having 0° at N and S and 90° at East and West.
(3) Sighting Vanes	(i) The object vane consists of metal vane with a vertical hair.	(i) The object vane consists of metal vane with a vertical hair.
	(ii) The eye vane consists of a small metal vane with slit	(ii) The eye vane consists of a metal vane with a fine silt.
(4) Reading	(i) The reading is taken with the help of a prism provided at the eye slit.	(i) The reading is taken by directly seeing through the top of the glass

(5) Tripod	Tripod may or may not be provided. The instrument can be used even by holding suitably in hand.	The instrument cannot be used without a tripod.

Ex 5.2 The following bearing were observed while traversing with a Compass.

Line	F.B	B.B
AB	45° 46'	226° 10'
BC	96° 55'	277° 5'
CD	29° 45'	209° 10'
DE	324° 48'	144° 48'

determine the corrected bearings.

Sol. Difference b/w back and fore bearing of line DE is 180°. So stations D and E are free from local attraction. So bearing of line DC is correct.

at station C.

$209° - 16° - 180° = 29° 10'$

Correction = $-35'$

$\Rightarrow$ Correct bearing of CB = $277° 05' - 35' = 276° 30'$

" " BC = $276° 30' - 180' = 96° 30'$

given bearing of BC = $96° 55'$

correction for B station = $96° 55' - 96° 30' = +25'$

and correction = $-25'$

Bearing of BA = 226°10' − 25' = 225°45'

Bearing of AB = 225°45' − 180° = 45°45'

Bearing of AB is same as the observed one. So station A is free from local attraction.

line	observed bearing	correction	corrected bearing	Remark
AB	45°45'	0	45°45'	
BA	226°10'	−25' at B	225°45'	
BC	96°55'	−25' at B	96°30'	stations
CB	277°05'	−35' at C	276°30'	B and C
CD	29°45'	−35' at C	29°10'	are affected
DC	209°10'	0	209°10'	by local
DE	324°48'	0	324°48'	attraction
ED	144°48'	0	144°48'	

☆ Numericals : Related to Essors in Linear Measurement

Eg.(1) The length of a survey line measured with a chain of 20 m nomical length was found to be 841.5 m. When the chain was compared with a standard chain, it was found to be 0.1 m too long.

Find the correct measured length.

Sol. $L = 20\,m$, $l' = 841.5\,m$

$L' = 20.1\,m$

Correct measured length (l) = $\frac{\text{Actual length of chain}}{\text{Designed length of chain}} \times$ measured distance

$$l = l' \left(\frac{L'}{L}\right)$$

$$l = 841.5 \left(\frac{20.1}{20}\right)$$

$$\boxed{l = 845.7\,m}$$

Important Formulas:

ERROR due to INCORRECT chain :-

[1] $\boxed{l = l' \left(\frac{L'}{L}\right)}$

l' = measured distance

L → designed length of the chain

L' → Incorrect actual length of chain

[2] $\boxed{A = A'(1 + e)^2}$ $\quad e = \frac{\Delta l}{l}$

[3] $\boxed{V = V'(1 + 3e)}$

Q. (Ex. 6.6)

case 1st	case 2nd
$l' = 1200\,m$	$l' = 1212\,m$
$L' = 20\,m$	$L = 25\,m$ $\quad \boxed{l = ?}$
$L' = 20.1\,m$	$\boxed{L' = ?}$

Find the actual length (L) of the 25 m chain?

Sol.

$$l = l' \left(\frac{L'}{L}\right)$$

$$l = \left(\frac{20.1}{20}\right)(1200)$$

$\boxed{l = \text{correct measured distance} = 1206\,m}$

$\Rightarrow \quad l = l'\left(\frac{L'}{L}\right)$

$= 1206 = 1212\left(\frac{L'}{25}\right)$

$L' = \frac{1206 \times 25}{1212}$

$\boxed{L' = 24.88\ m}$

Thus, the 25 m chain ~~is~~ was 0.12 m too short

Exc-6

Given ⇒

$L = 30\ m$ $\qquad$ $1\ cm = 10\ m$

$A' = 51.46\ cm^2$

Length of the chain was found to be 30.01 m at the beginning and 30.03 m at the end.

* Find the correct Area (A) = ?

Sol.

$$A = A'\left(1 + 2\times\frac{L'}{L}\right)$$

$L' = \frac{30.01 + 30.03}{2} = \boxed{30.02\ m}$

$\boxed{L = 30\ m}$

$A' = 51.46\ cm^2$

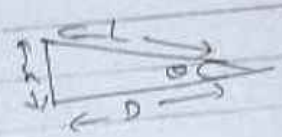
$\boxed{A' = 5146\ m^2}$ $\qquad$ $(\because 1\ cm = 10\ m)$

$A = 5146\left(1 + 2\times\frac{30.02}{30}\right) = 5152.86\ m^2$

★ Formula :-

[1] Error due to Non-Horizontality of chain :-

(a) If angle of slope is measured :-



$$\text{Correction} = L(1 - \cos\theta)$$

L = measured distance

D = Horizontal distance

h = difference in elevation of the end point

Ans [b]

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

[2] Error due to Temp. :-

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

C_t = Temp. corr.

T_0 = Temp. at which the chain was calibrated

T = Field Temp.

L = Measured Length

[3] Error due to pull/Tension c)
Correction

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

L = measured length
P_0 = standard pull
P = pull applied

xxx

[4] Correction for absolute length:-

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

L → measured length
l = nominal length

[5] Corr. for sag →

$$C_s = \frac{l_1 (w l_1)^2}{24 P}$$

w = wt of tape
l_1 = ~~measured~~ length of tape between supports
P = applied pull

xxx

☆ Prismatic Compass :-

It is a more conventional, handy, portable instrument for measuring angle.

→ It is circular in shape and its diameter varies from 85 mm to 110 mm.

↳ It is made of non-magnetic metal.

→ A prismatic compass consists of :-

(1) ↳ A magnetic needle is supported on a pivot.

(2) ↳ A graduated aluminium ring attached with the needle. The graduated ring devided into degree and min.

(3) The graduations start from zero marked at the South end of the needle and they are run clockwise so that 90°, 180°, 270° are marked at west, North and East.

(4) The eye vane and object vane fixed in opposite side to each other.

(5) The break pin provided to stop the graduated ring.

(6) A glass cover provided at the top so that dust particles do not enter the compas box.

Surveyor's compass:-

The surveyors compass is used for land surveying.

(i) The graduated ring is attached to the circular box and not with magnetic needle.

(ii) The edge bar magnetic needle is provided to freely floats over the pivot.

(iii) There is no prism in the surveyor's compass. Only a plain slit is provided to act as an eye vane.

(iv) Reading is taken against the North end of the needle.

(v) The ring is graduated in quadrantal system having 0° at North and South ends and 90° at East and west ends.

☆ Temporary adjustment of Compass:-

The temp. adj. of a magnetic compass consist of Centering, Levelling, and Focusing the prism.

[1] Centering:- The process of making the pivot exactly vertically over the ground station mark is called centering.

↳ A compass is fixed on top of a tripod and by adjusting the legs of tripod. A plumb bob may be hung from the centre of compass circular box to check the compass centering. If the plumb bob the compass is centered the plumb bob falls exact on the station.

(2) Levelling :- The process of adjusting the compass such a way that its graduated ring swing freely, is called levelling. It is done by eye judgement.

[3] Focusing the prism :- The process of moving the prism up or down for obtaining the figures and graduations sharp and clear is called focusing of prism.

The temporary adj. is only applicable for prismatic compass.

★ Local attraction :- local attraction is the attraction of the magnetic needle to a local magnetic field other than the earth's magnetic field.

The magnetic field is caused by iron pipes, steel bars etc.

Temporary adjustments of Level :-

[1] Centring :-

(a) Fixing the instrument on stand.

(b) Levelling the instrument approximately by legs adjustment

↳ To fix a level to the tripod, the clamp is released, instrument held in right hand and is fixed on the tripod, by turning round the lower part with the left hand.

↳ Tripod legs are so adjusted that the instrument at a sufficient height.

(a) Levelling :- levelling is done with the help of foot screws and with reference to plate level.

↳ The purpose of levelling is to make the vertical axis truly vertical.

(c) Elimination of parallax :- It does 2 part

(i) To bring the cross-hairs in the distinct of your eye.

(ii) Focusing the object by focusing screw.

★ Reciprocal levelling:-

Reciprocal levelling is adopted to calculate the true difference in levels of two points.

↳ where it is not possible to set up the instrument midway for balancing the back sight and fore sight.

↳ Reciprocal levelling is used to determine the difference of elevations of two points on the opposite side of a river, deep valley etc.

↳ Reciprocal levelling eliminates the errors due to curvature, refraction.

★ Let A & B are two points on the opposite of rivers

(ii) ↳ Set the instrument near the point A at L_1
Note the readings a and b on the staffs held at A and B points

(iii) Now shift the instrument to point B at L_2.
Note the readings a' and b' on the staffs held at A and B points.

Correct difference of elevations between points A and B.

$$h = \frac{(a-b)+(a'-b')}{2}$$

★ Curvature correction :)

The line of sight is a straight line assumed to be free from the effect of refraction. The level line is curved line. ~~Thus~~ due to curvature of earth, readings taken on a levelling staff held vertically, are always more than that what these would have been if the earth had a plain surface.

Principle of Surveying -

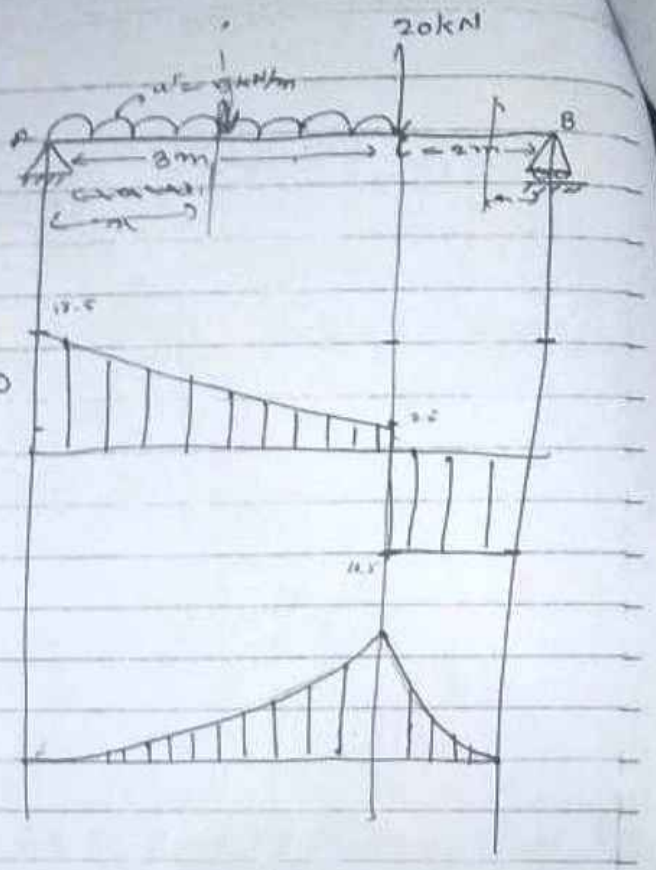
[1] **Whole to part** => The first principle of surveying is to work from the whole to the part. The surveyor should first establish a large main framework consisting of widely spaced control points.

↳ Minor control points, in between primary points.

↳ The main idea of working from the whole to the part is stop the accumulation of errors and to localize minor errors within the framework of the control points.

[2] The second principle of surveying says that "the positions of new stations should be fixed by the least two measurements.

Measured the distance between two points and plotted then on a sheet. Say main control points are P and Q. Then R is the point which is find to out. Find by trignometric method.



Reaction $\Rightarrow \Sigma V = 0$

$R_A + R_B = 20 + 15 = 35kN$

$M_{R_C} = 0$

$R_A(0) - 0(1.5)(1.5) - 20(3) + R_B(5) = 0$

$5R_B = 60 + \frac{22.5 \times 5}{2}$

$= \frac{116.25}{5}$

$R_B = 23.25$

$5R_B = 60 + 15(1.5)$

$R_B = 16.5\ kN$

$R_A = 18.5\ kN$

S.F. BC

$f_x = -R_B = -16.5\ kN$ → $F_B = -16.5kN$, $F_C = -16.5kN$

AC $\Rightarrow f_x = 18.5 - 5(x)$ → $x=0$: $F_A = 18.5$; $x=3$: $F_B = 18.5 - 15 = 3.5\ kN$

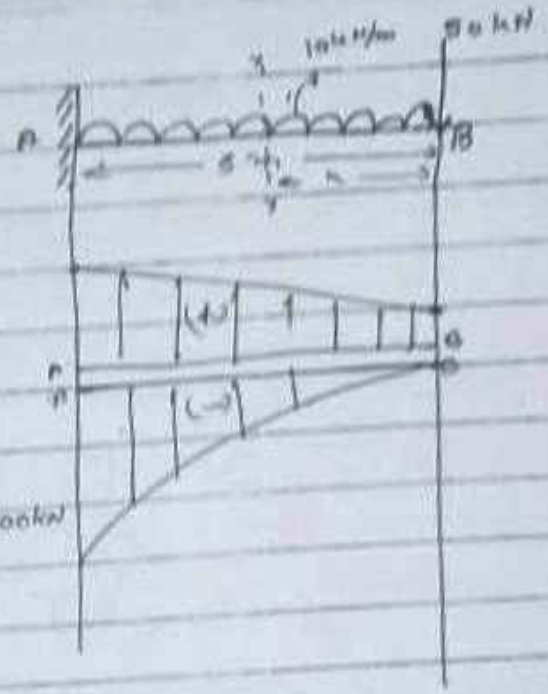
B.M.

AC

$M_x = R_A x - (5)(x)\frac{(x)}{2}$ → $x=0$: $M_A = 0$; $x=3$: $M_C = 18.5 \times 3 - \frac{5(3)^2}{2} = 38kN$

BC

$M_x = R_B x - 16.5(x)$ → $x=0$: $M_B = 0$; $x=2$: $M_C = 33$



Q

S.F. :-

$F_x = +10x \rightarrow$ [$x = 0$, $F_B = 0$; $x = 5$, $F_A = 10 \times 5 =$]

$F_x = +50 + 10x \rightarrow$ [$x = 0$, $F_B = 50\,kN$; $x = 5$, $F_A = 50 + 50 = 100\,kN$]

B.M. @ B

$M_x = -50x - 10x\left(\frac{x}{2}\right)$

$x = 0$

$M_B = 0$

$x = 5$

$= -50 \times 5 - (10)5\left(\frac{5}{2}\right)$

$= -250 - 125$

$M_A = -375\,kN$

(b) Reaction ⇒

$\sum V = 0$

$\Rightarrow R_A + R_B = 50 + 10(2.5) + 10(2.5)$

$R_A + R_B = 50 + 25 + 25$

$\boxed{R_A + R_B = 100 \text{ kN}}$

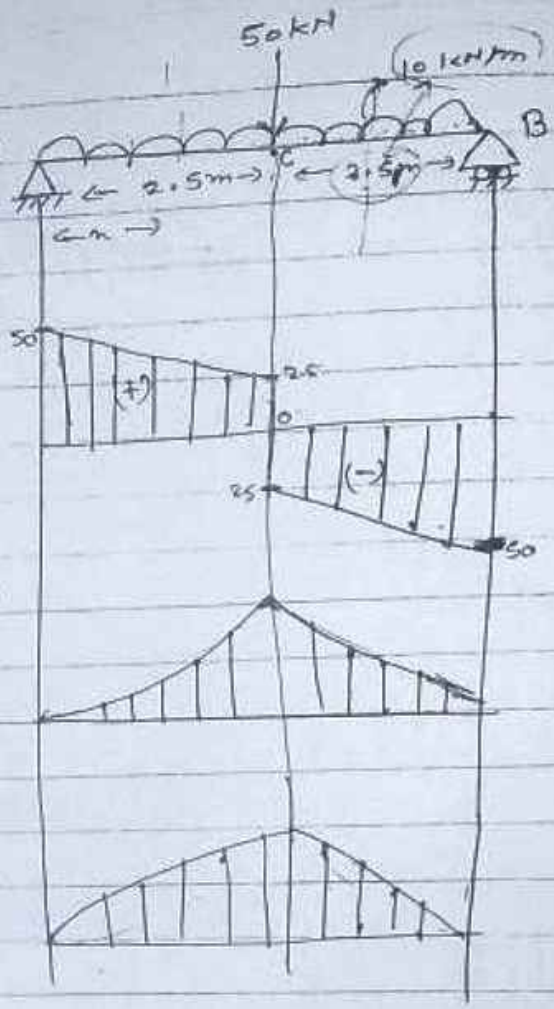
$\Rightarrow M_A = 0$

$R_B(0) - 10(2.5)\left(\frac{2.5}{2}\right) - 50(2.5) - 10(2.5)(3.75) + R_B(5) = 0$

$5R_B = +31.25 + 125 + 93.75$

$R_B = 50$

$\boxed{R_A = 50 \text{ kN}}$ $\boxed{R_B = 50 \text{ kN}}$



⇒ S.F. BC

$F_{xx} = -R_B + 10x$

$x = 0 \Rightarrow F_B = -50$

$x = 2.5 \Rightarrow F_C = -50 + 25$

$F_C = -25 \text{ kN}$

S.F. AC

$F_x = 50 - 10x$

$x = 0 \Rightarrow F_A = 50$

$x = 2.5 \Rightarrow 50 - 25$

$\boxed{F_C = 25 \text{ kN}}$

⇒ B.M. BC

$M_{xx} = +R_B x - 10x\left(\frac{x}{2}\right)$

$x = 0 \Rightarrow M_B = 0$

$x = 2.5 \Rightarrow M_C = 50(2.5) - 10(2.5)\left(\frac{2.5}{2}\right)$

$M_C = 93.75$

AC $\quad M_{xx} = -50x + 10x\left(\frac{x}{2}\right)$

$x = 0 \Rightarrow M_B = 0$

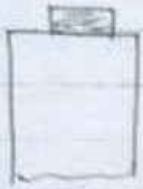
$x = 2.5$

$M_C = +50(2.5) + (10)(2.5)\left(\frac{2.5}{2}\right) = +93.75$

→ Transmission of Power by Belts and Ropes :-

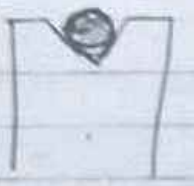
★ Types of Belts → [1] Flat Belt [2] V-belt [3] Circular Belt

[1]

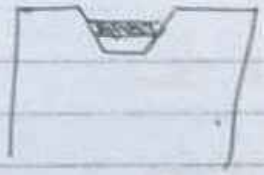


Mostly used in factories and workshop.

[3]



[2]



WATER

Sources of water and Their Quality

Sources of water

- surface sources (useful for big cities and industrial town)
  - → Lakes
  - → Rivers
  - → Reservoirs (dams)
  - → canals
- Underground Sources (use for village and small town)
  - → Open wells
  - → Tube wells
  - → infiltration wells
  - → infiltration Galleries (infiltration)

Quality of surface source	Quality of under ground source
1 Impurities Present (a) Inorganic - silt, clay, etc. (b) organic - Plants, dead organic material and animals algae and weed growth in still water	→ Impurities Present → Dissolved salts, minerals and gases etc.
2 Generaly soft and less corrosive	→ Generaly hard due to dissolved salts of Ca and Mg. Percolation through stara of soil
3. Turbidity is more pH Ranges btw 6.5 to 7.5, Hardness Ranges between 30 to 150 mg/l.	→ Turbidity is less pH is more than 7 Hardness → 100 to 600 mg/l.

Rivers

* Surface water source may be further classified as :-

[a] Lakes ⇒ A lake is formed due to the collection of water in a natured basin or depression in a mountainous area or in plains. Sometimes, a stream may lead is water into these basins.

[b] Reservoirs ⇒ The discharge in a river or stream decreases during summer. The obtain a continuous supply of water.

[c] Rivers, streams, erigation canles.

The quality of water from a river or stream depends on the.

(a) Charcter and area of the catchment.
(b) Topography
(c) Extent and nature of development of catchment by human beings.
(d) seasonal and weather conditions.

* Source of Underground water :-

(a) Spring ⇒ Springs are formed formed due to emergence of ground water to the surface. Spring water

Contain minerals dissolved from sub-soil layer
Spring water from shallow starts is more likely
to be affected by surface pollution.

[b] Wells ⇒

The vertical hole due to out or drilled
the ground to get sub-surface water in termed
as well
well may be classified as :-

(i) Shallow well (ii) Deep well (iii) Sunk well
(iv) Driven well (v) Dug well (vi) Boxed well

[c] infiltration Gallery ⇒

Water is collected in the
gallery and led to a well called jack well placed
at the shore.

[d] Infiltration wells ⇒

An infiltration well is wel
in a river or streambed.

Impurities in water :-
water either from surface source or undergound
source contains numbers of impurities in varying
amounts ammounts. Impurities are classed as follows.

(i) Suspended impurities ⇒ These impurities are Impurities in the form of suspension / dispersion of solid particles. which can be removed by sedimentation or filtration.

(ii) Colloided impurities ⇒

These impurities are in form of every finaly divided dispersion of particles in water. These impurities being every small cannot removed by ordinary filters.

(iii) Dissolved impurities ⇒

These impurities may be in the form of a solides, leguide or gases.
These type of impurities may contain organic and inorganic compounds.

Impurities Removed :-

Process	Impurities Removed
1. Screening	It is adopadopted to remove floating matter. It is provided at the intake points.
2. Aration	It removes objectionable taste, odour and Dissolved oxygen gases like CO_2 and H_2S. Dissolved oxygen is increase

3. Plain sedimentation	It is adopted for removing settleable suspended impurities like silt, sand etc. which are heavier than water
Disinfection	All remaining organisms including pathogens are destroy -
Filtration	It is the most important stage in the treatment. Colloidal and very fine particles escaped from sedimentation take are removed.

Self - purification of streams ⇒

When sewage is discharged into a natured body of water like streams the receiving water gets polluted due to waste products present in sewage effluent. But the condition do not remain so for ever, Because the natural forces of purification such as dilutions, sedimention, oxidation - - reduction in sunlight, such as dilution etc.

In Natural streams there is balance between plant and Animals life, when organic matter enters the streams, the bacteria break them down into ammonia.

When excess organic matter is led into the streams bacteria graw rapidly and cause depletion of oxygen.

Basic of waste water treatment :-

It is already seen that raw water belonging to any source may contain various impurities as

(i) Physical impurities
(ii) Chemical "
(iii) Bacteriological "

Physical impurities impart turbidity, taste, odour and colour to the water. Chemical impurities depending upon the nature and extent of amount present any - impart, alkalinity, hardness etc.

These impurities will be present in water in suspend colloidal or dissolved form.

The object of water treatment to remove to reduce impurities upto acceptable standard before the water is supplied to the public.

Treatment of water :-

The complete process of removes of undesirable matter in order to make the water acceptable for domestic of or industrial use is commonly termed as treatment of water or purfaction of water.

★ object treatment of water ⇒

[1] To make watis odour free and tasty.

[2] To make is colourless.

[3] To remove dissolved gases and turbidity of water.

[4] To remove harmful bacteria.

[5] To remove hardness of water.

★ Eutrophication of lakes :-

The condition of excessive growth of plants, in a water body, is called Eutrophication. Eutrophication is a natural process of again of a water body. It is a result of a very slow process of natural sedimentain of microscope. organism, which take geologic times to complete. The process of Eutrophication is propelled by increasing ~~cancer~~ conventration of nutrients necessary for biogical activity.

The bacterial decomposition fail to kep pace with the production of organic

ENVIRONMENT

★ Basic of Environment ⇒ Mim lros always inhabited two worlds. One is the natural - wodd of plants, animals, air, water, and soil of which man himself is a part, while the other is the 'built - world' of social institution and artifacts which he created for himself by using science and technology, and paltical.

Since man inhabited both the world they constitute an important part of the Environment.

★ Globle of Environment issues ⇒

The globle environment consists of the lithosphere, the hydrosphere and the atmosphere - The lithosphere is the soil matmalte that wraps the core of the earth, in which the biological activities take place. The hydrosphere consists of the oceans, sivers, lakes, and the shallow groundwater bodies of the oceans, sivers, glaciers and the shallow ground water bodies tham interflow with the surface water.

Approximately, 70% of earth's surface is covered of gases, and suspended liquieds and solid

* Environmental issues ⇒ The various (many parts) segments of the environment may has harmful biological and chemical agents that can have a significant impact upon the health of humans.

High concentrations of SO_x, NO_x, CO_x, CO, SPM and other contaminants in atmosphere pose direct and indirect threats to human health.

Clean and clear, sparking rivers, streams and lakes are an aesthetic delight.

xxo

Environmental laws in India

There are three key policies dealing to environmental protection in India. They are

1. The National Forest Policy, 1988
2. Policy statment for Abatment of pollution, 1992
3. National Conversation strategy strategy and policy statment Environment and deulopment, 1922

According to section 2(a) of the Enviorm Environmental protection Act, 1986, Environment includes

(a) water, air and land
(b) The inter relationship which exists among and between.
(i) water, air, land and
(ii) human beings, other living creatures, plants, microorganims and property.

The different statues / legislations enacted in India exclusively for enviranment protection are:-

1. The water (Prevention and control of pollution) Act, 1974
2. The water (Prevention and control of pollution) Rules, 1975
3. The Air (Prevention and control of pollution) Less Rules, 1978
4. The Environment (Protection) Act, 1986
5. The Forest (conservation) Act, 1980

There are about two hundred laws dealing with environment protection both before and after independence in India.

Concept of sustainable development :-

More the hundred definitions of sustainable development exist, but the most widely used one is from the world commission on Environment and development presented in 1987. [This law is stating that sustainable development is "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."]

Sustainable development promotes the idea that social, environmental, and economic progress are all attainable within the limits of our earth.
Sustainable development approaches everything in the world as being connected through space, time and quality of life.

Some of the most common examples of sustainable development ~~protation~~ process are :-

- Solar and wind energy : Energy from these ~~shown~~ sources is limitless, meaning have the ability to eliminate dependance on non-renewable resources.

- Croprotation :- Many farmers and gardners are using their method as a chemical free way to reduce discreases in the soil and increases growth

potential of their crops.

- Water fixtures :- Water conservation is critical to sustainable development, and more and more products are available that use less water in the home, such as showers, dishwashers and laundary systems.

★ Concept of integrated built environment :-

⇒ The term buil environment refers to the human-made surroundings that provide the setting for human activity, ranging in scale from buildings and parks of green space to neighbourhoods and cities that can often include their supporting infrastructure, such as water supply, or energy networks.

⇒ The built environment is a material, spatial and cultural product of human labor that combines physical elements and energy in forms for living, working and playing.

⇒ It has been defined as "the human-made space in which people live, work and recreate on a day-to-day basis.

Role of an individual in Conservation of natural resources

1. Conservation Energy:-

a) Swith of lights, fans and other appliances when not in use.
b) use solar heater for cooking your food on sunny days which will save LPGs for future generations.

c) Grow trees near the houses and get a cool breeze and shade, this will cut your electricity charges.

d) Always use pressure cookers.

2. Conservation of Soil :-

a) Grow different types of plants, trees and grass in your garden, which bind the soil and prevent erosion.

b) By reducing the use of fertilizers and pesticids.
c) use natural manure to the Crops.
d) While constructing the house don't uproot the trees as far as possible.
e) use mix mixed cropping, so that some specific soil nutrions will not get.

3. Conservation water :-

a) use minimum amount of water for all domestic purposes.

b) Check for water leaks in pipes and repair them promptly

c) Reuse the soapy water, after washing clothes, for washing off the drive ways etc.

d) Built rain water harverting system in your house.

4. Conservation of food ~~Resources~~ Sources :-

a) Don't waste the food instead give it to someone before getting spoiled.

b) Cook only required amount of food.

c) ~~Restate~~ Restore the food resources for the future use

5. Conservation of forest :-

a) Use non - timer products

b) Plant more ~~tt~~ trees and protect them.

c) over grassing must be controlled.

d) Minimise the use of papers and fual wood.

—xxx—

Concept of Ecosystem

Ecosystem structer and Function :-

Biogeorphy reveals that living organism (Parts and animals) are found practically everywhere on this earth. The living components interact among themselves as well as with their physical environment like soil and water.

Ecosystem Defination ⇒ An ecosystem can be defined as a structural and functional unit of biosphere of segment of nature consisting of community of living exchanging materials between them.

Components of an Ecosystem ⇒

These include the non-living phsica-chemical factors such as air, water, soil and the basic elements and compounds of the environment.

Food Chain ⇒ Food chain is a series of group of organism called trophic levels, in which there is repeated eating and eaten by so as to tranfer food energy.

★ Characteristic of food Chain ⇒

There is repeated eating in which each group eats the smaller one and is eaten by the larger one. Thus, it invales a nutritive interaction between the biotic components of an Ecosystem.

★ Types of Food chain ⇒

Grazing food chain in generally seen in Ecosystem such as grassland, pond or lake where as substential part of the net primary production is grazed on by harbours (cattel and so dents). Thus, in these, Ecosystem, the food chain is harbivores based.

★ Major Ecosystem ⇒

There are three major ecosystem types in the country.

[i] Direct Ecosystem ⇒

These cover over 80% of the total land area and are presented mainly by the desert of the ~~est~~ Southern.

(ii) Ecosystem of their valleys ⇒ The legal complexes prese
the major Ecosystem typ
of the river valleys within the desert zone.
These include three (populus, salix, and elaegnu
shrubs.

(iii) Mountain Ecosystem ⇒ These include the mounte
ranges of grather balkhan.
lesser balkhan, Kyurenday, Kopetdar. Badkhyz,
Kyllangbas as well as degraded mountains of
the ~~south~~ Southern ustyure.

★ Biodivesity ⇒ Is the degree of variation of life. These
refer to genetic variation, Species Variat
or Ecosystem variation within an area, become ex
planet. Terrestrial biodiversity ~~tend~~ tends to be highest n
ear the equator. which seems to be the result
of the warm climate and high primary productivi
marine biodiversity tend to be highest along coas
in the western pacific.

Rapid environment changes, typically cause mass
extinction. One estimate is that <1%–3% of th
species that the existed on earth are extant

★ Gentic diversity ⇒ The level of biodiversity, ref to the total number of genetic characteristics in the genetic makeup of species. It is distinguished from genetic variability, which describes the tendency of genetic diversity serves as a every for population to adpat to changing environments. Those individual individuals are more likely to survive the produce offspring bearing that allele.

★ Species diversity ⇒ Is the effective number of different species that are represented in a collection of individuals. The effective number of species refers to the num of equally abundant species needed to obtain the same mean proportinal species abundance as that observed in the dataset of interest (where all species may not be equally abundant). Species diversity consist of two components:

[i] Species richness
[ii] Species evenness

★ Ecosystem diversity ⇒ Refers to the diversity of a place at the level of ecosystems. The term differs the from biodiversity, which refers to variation in species rather than ecosystem.

Ecosystem diversity can also refer to the variety of ecosystem present in a biosphere, # the varity of species and ecological processes that occurs in different physical setting.

Some example of ecosystems that are rich in diversity are :-

(i) deserts (ii) Forests (iii) Large marine ecosystems

★ Value of Biodiversity ⇒