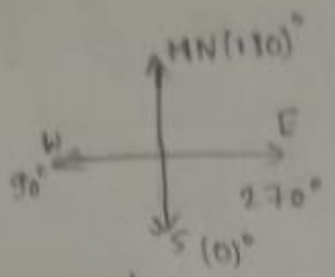
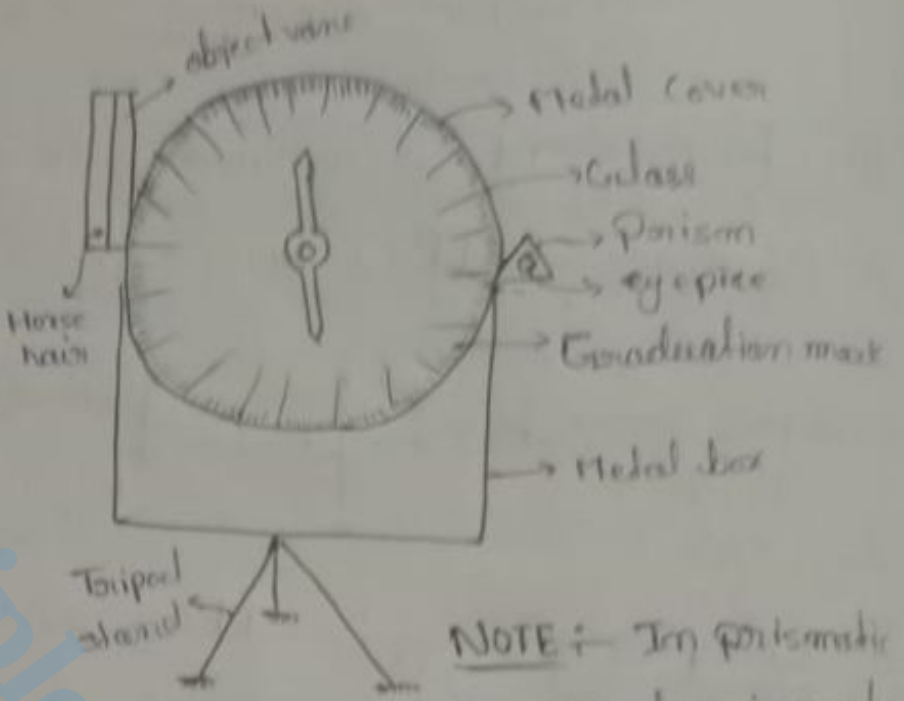
19th Dec

(11) Construction of Prismatic Compass :-





Components :-

(i) Metal cover
(ii) Glass
(iii) Pivot
(iv) Magnetic needle
(v) Graduation mark
(vi) Prism
(vii) Eyepiece
(viii) object vane
(ix) Horse hair
(x) Tripod stand

NOTE :- In prismatic compass, bearing of a survey line is always measured with respect to Magnetic north (i.e MN)

NOTE :- The least count of prismatic compass is 30" i.e 30 minute.

(111) Temporary Adjustment of a Prismatic Compass :-

(i) Centering :- The process of making the instrument station on the ground by means of plumb bob.

(ii) Levelling :- The process of making the bubble at the centre of bubble tube by performing to and fro motion of tripod stand.

(iii) Observation :- and taking reading by means

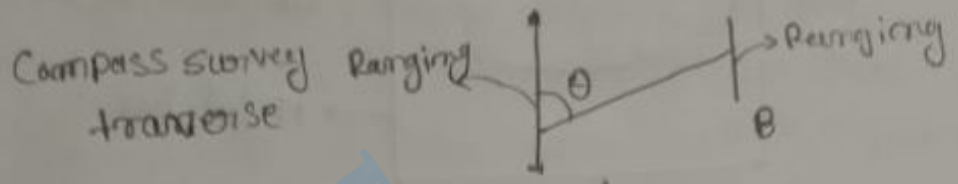
Reading of the bearing of the survey line.

UNIT NO - 03

Compass survey

(#) Chain :- It is a linear device ——— / |

(#) Compass :- It is an angular device.

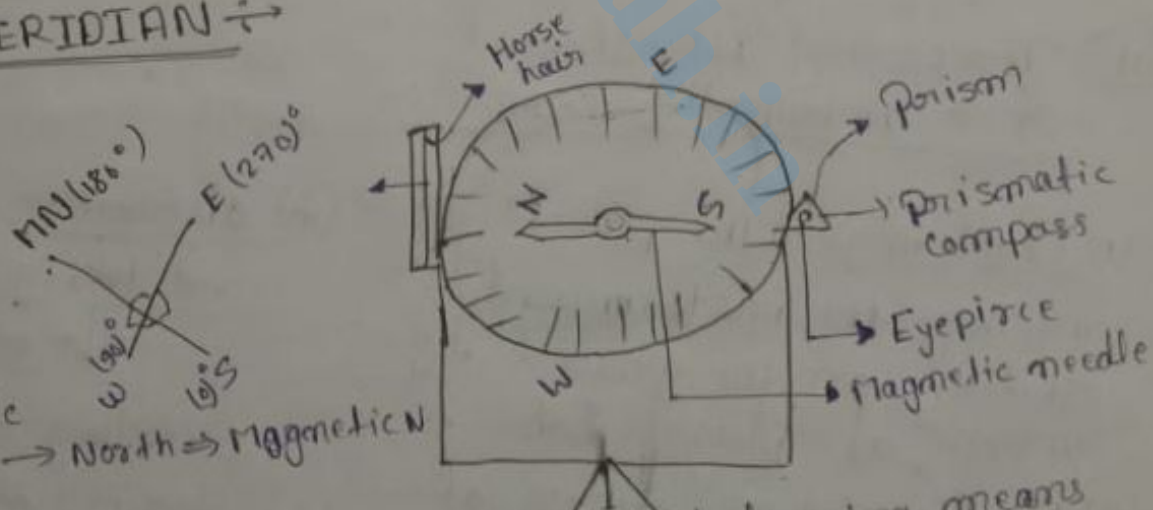


(#) Compass survey :- It is one of the type of instrumental survey in which the survey is perform with the help of compass survey is perform with the help of compass

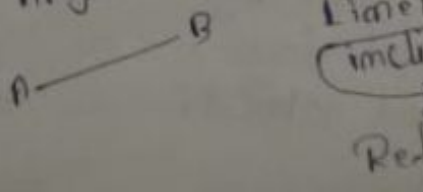
(#) Principal of compass survey :- Principle of Compass survey is based in traversing.

MIR

(#) MERIDIAN :-

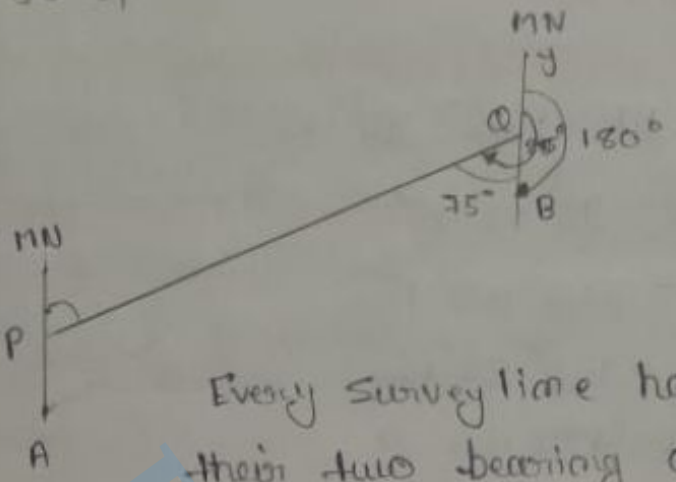


(#) Bearing :- Most simple word bearing means Angle.



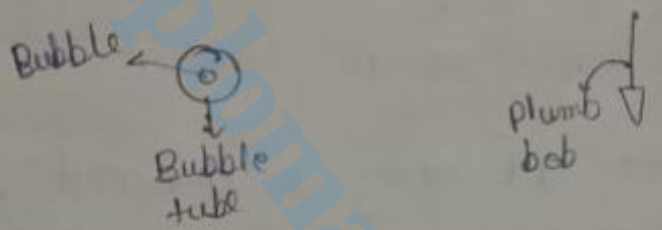
FB of line PQ = P to Q

BB of line QP = Q to P

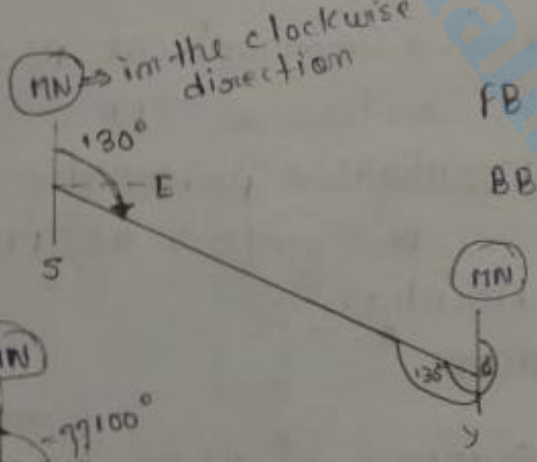


Every survey line have their two bearing and second one is back bearing

0° to 360°

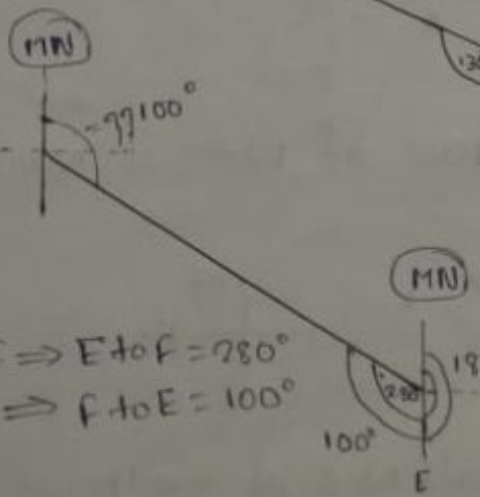


Back Bearing = fore bearing ± 180°



FB of line AB = A to B
= 130°

BB of line BA = A to B
= 310



FB of EF ⇒ E to F = 280°

BB of EF ⇒ F to E = 100°

Back bearing = fore bearing ± 180°

If FB > 180° then (−180°)

If FB < 180° then (+180°)

(I) Bearing :→ The angle between the survey line and the meridian is known as "Bearing".

Bearing is of following four types :→

(i) True bearing :→ The angle between the true meridian and the survey line.

(ii) Magnetic bearing :→ The angle between the magnetic meridian and the survey line.

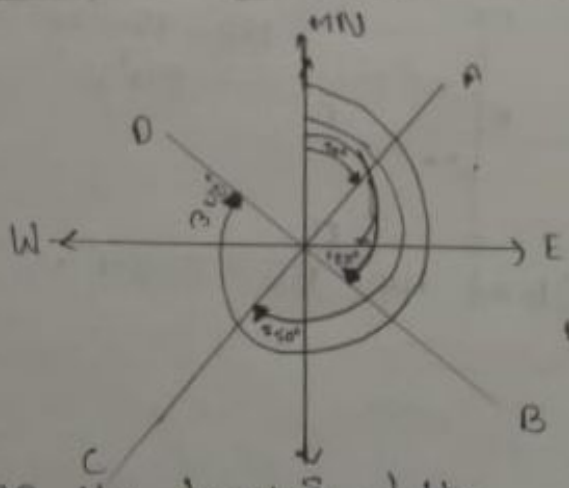
(iii) Arbitrary bearing

(iv) Grid bearing

(II) Representation of bearing of a survey :→

- WCB (whole circle bearing)
- QB (Quadrantal bearing)

(III) WCB → Whole circle bearing :→



↳ In WCB, the bearing of the survey line varies between 0° to 360°.

↳ In WCB, Bearing of OA = 30°
↳ In WCB, Bearing of OB = 120°
↳ In WCB, Bearing of OC = 260°

↳ In WCB, the bearing of OD = 300°

↳ In WCB, the bearing of survey line is always measured with respect to magnetic north in the clockwise direction.

Practice Question

find the back bearing for the given Survey line :-

(1) FB of line AB = 270° 30' 45'

⟹ BB of line AB = 90° 30' 45°

(2) FB of line PQ = 330° 25' 15"

⟹ BB of line PQ = 150° 25' 15"

(3) FB of line MN = 127° 30', 10"

⟹ BB of line MN = 307° 30' 10"

(4) FB of line xy = 80° 30' 15"

⟹ BB of line xy = 260° 30' 15"

16th DEC

(11) MERIDIAN :- It may be defined is the the reference with respect to which bearing of a Survey line is measured.

Meridian is of following four types

for solving the numericals

(i) True meridian → Geographical N.S of earth is refers as TM

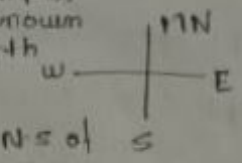
(ii) Magnetic Meridian :- Prismatic compass with N.S refers as "MM"

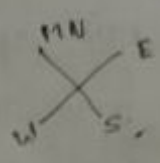
(iii) Arbitrary Meridian

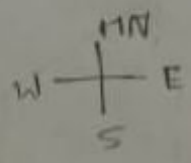
(iv) Grid Meridian

NOTE :- Prismatic compass of N.S is variable i.e vary place to place.

(*) Prismatic compass of north is known as magnetic north (i.e MN).

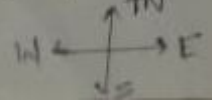






(*) Geographical N.S of earth is known as True north (i.e TN)

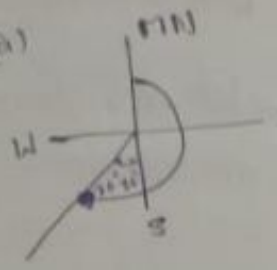
(*) Geographical N.S of earth is always constant.



Ques Convert the following QBs to WCB.

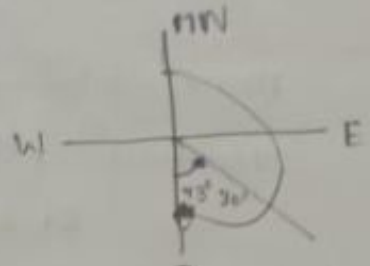
(a) QB of AB = S 36° 30' W = 216° 30'
(b) QB of BC = S 43° 30' E = 136° 30'
(c) QB of CD = N 26° 45' E = 26° 45'
(d) QB of DE = N 40° 15' W = 319° 45'

Sol^{n} (a)



$180° + 36° 30'$
$= 126° 30'$
$\therefore$ WCB of AB = $216° 30'$

Sol^{n} (b)



$180° - 43° 30' = 136° 30'$

24th DEC

LEVELLING

(#) Levelling :→

(elevation)

↳ It is the part of Surveying in which we determine the position of various points situated on the earth surface with respect to MSL (i.e Mean sea level).
or in other word we can say that :-

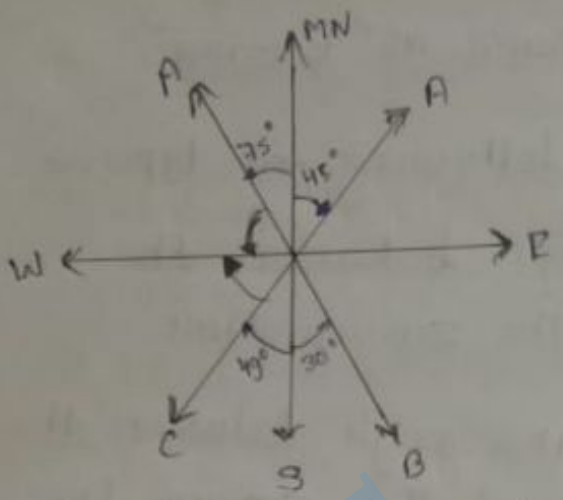
↳ Levelling is the measurement in the vertical plane.

Level difference of two surface
↓
Not exist ⇒ Horizontal plane

(up) Surface

Level difference of two surface
↓
Exist
↓
vertical plane

(11) Quadrantal bearing → (QB)



↳ In QB, the bearing of a survey line is measured either with respect to magnetic north or south, whichever is nearer.

↳ In QB, the Bearing of a survey line is measured in clockwise direction as well as Anticlockwise direction.

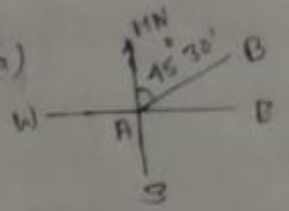
↳ In QB, the bearing of a survey line is varies between 0° to 90°.

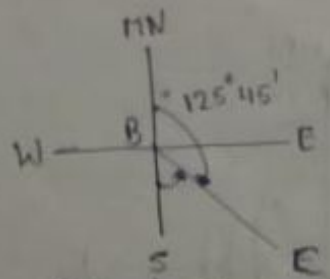
↳ QB of line OA = N 45° E
↳ QB of line OB = S 30° E
↳ QB of line OC = S 49° W
↳ QB of line OD = N 75° W

Ques Conver the following WCB, to QBs

(a) WCB of AB = 45° 30'
⟹ N 45° 30' E
(b) WCB of BC = 125° 45°
⟹ S 54° 15' E
(c) WCB of CD = 222° 15' =
(d) WCB of DE = 320° 30' =

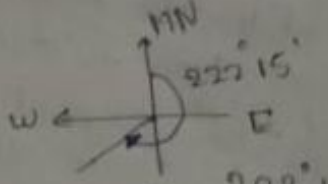
Sol^n (a)





180° − 125° 45'
= 54° 15'

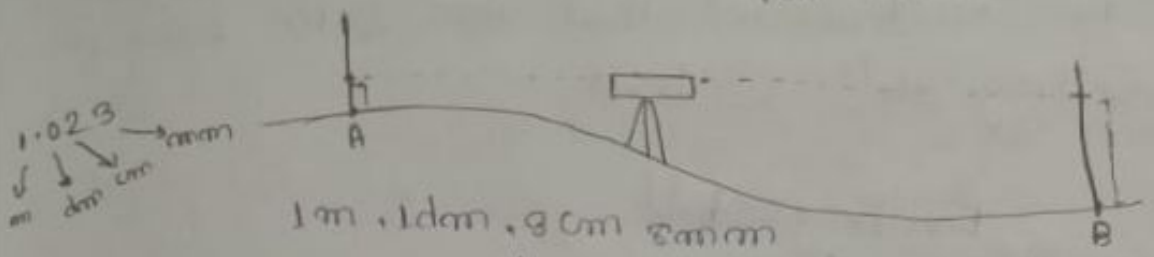
QB of line BC = S 54° 15' E



222° 15' − 180°
= 42° 15'

1 dm = 10 cm
1 cm = 10 mm

7088 org
3084085



1 m, 1 dm, 8 cm 8 mm

1.000
0.100
0.030
0.008
1.138

Ans for performing the levelling operation; we need two important instrument :-

(i) level (ii) Levelling staff

1 m = 10 dm
1 dm = 10 cm
1 cm = 10 mm
1 m = 100 cm
1 m = 1000 mm

1 m = 1 m
0.0 m = 0 dm
0.03 m = 3 cm
0.008 m = 8 mm
0.038 m

m का devision → dm
dm का devision → cm
cm का devision → mm
1 cm = 10 mm

Traditional way :-
1 m 1 dm 6 cm 8 mm
1.0 m
0.1 m
0.06 m
0.008 m
1.168 m

Short cut way = 1.168 m

21th DEC

(ii) Reading of levelling staff :-

Traditional way

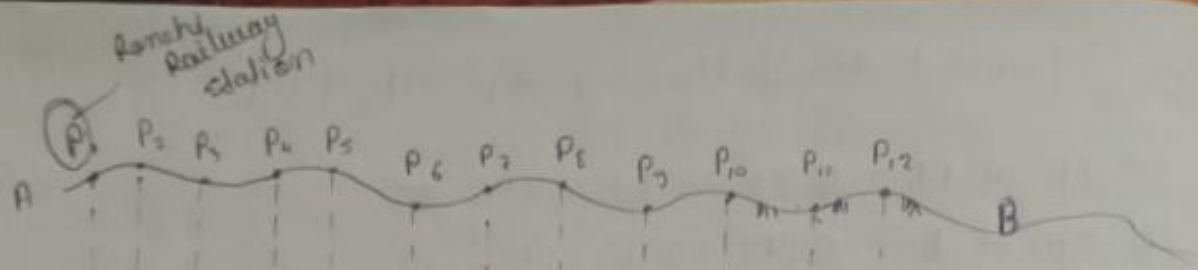
0 m = 0.0 m
7 dm = 0.7 m
4 cm = 0.04 m
4 mm = 0.004 m
0.744

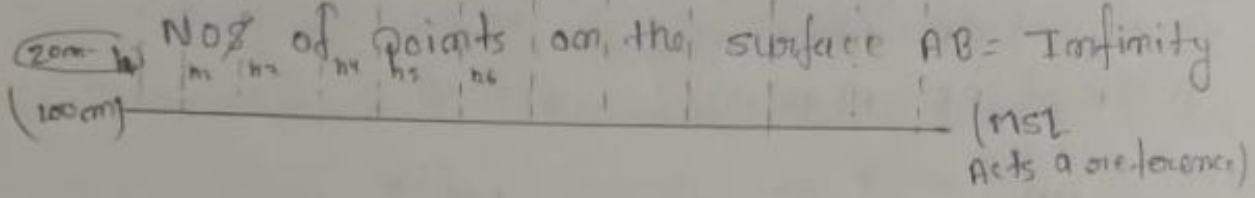
1 m = 1.0 m
0 dm = 0.0 m
3 cm = 0.03 m
8 mm = 0.008 m
1.038 m

short cut way

0.744 m

1.038 m



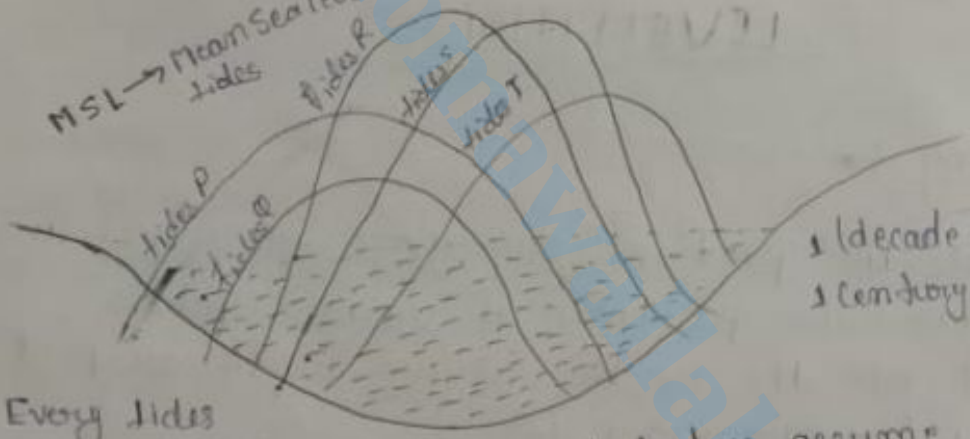


No. of points on the surface AB = Infinity

Horizontal plane $\xrightarrow{\text{measurement}}$ Hori-zontal measurement

Vertical plane $\xrightarrow{\text{measurement}}$ vertical measurement

RL of point P_1 = RL of MSL + hi
= 100m + 20m
= 120m



1 decade (दशक) = 10 years
1 century (शताब्दी) = 100 years

Every tides have their certain or specific height:-

tides P = y_1 tides S = y_4
tides Q = y_2 tides T = y_5
tides R = y_3

Let us assume we analyze height of various tides for last 5 to 10 years

Average tides height = $\frac{y_1+y_2+y_3+y_4+y_5}{5}$

⟹ MSL = 100m

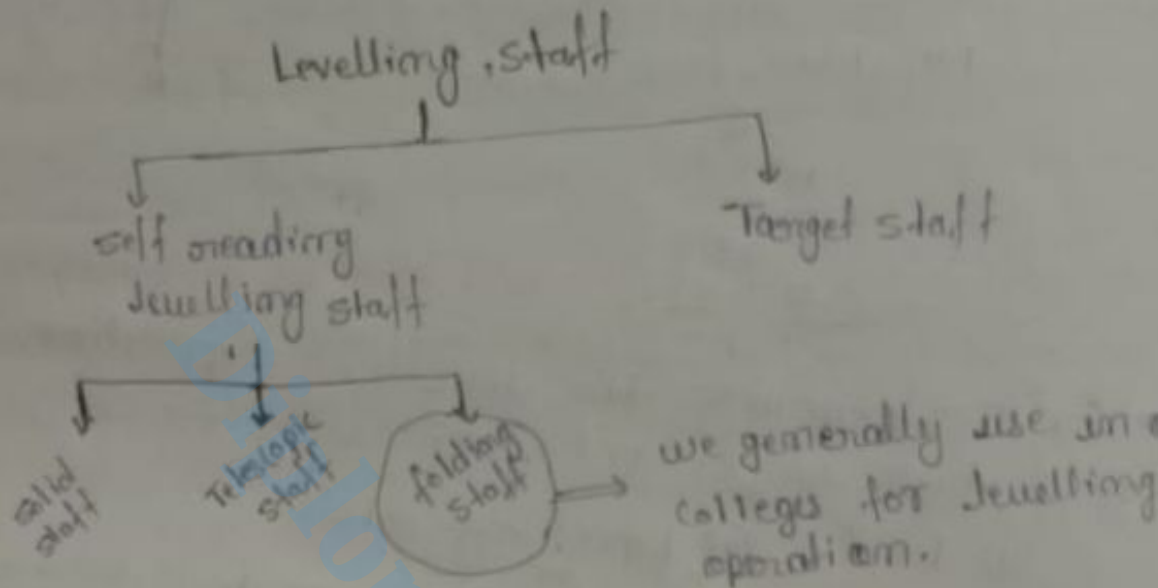
V.V.I **RL of a point or Reduced level of a point :-**

RL of a point may be defined as its elevation with respect to (MSL)

→ For performing the levelling operation ; we need mainly two instrument that are listed below :-

① Levelling staff ② Level

(ii) Levelling staff



(iii) Different Types of Level :-

① Dumpy level → we generally use in our colleges for levelling operation.
② Auto level
③ Tilting level → for the construction of road ; we generally use auto level.
④ Wye level
and so on

→ All these levels are mainly used to read out the levelling staff reading.

(11) Temporary Adjustment in a dumpy level :→

① Centering :→ The process of establishing the position of instrument on the ground by the help of plumb bob ; is known as "Centering".

② Levelling :→ The process of making the bubble of primary tube a longitudinal tube at the centre and also making the bubble of secondary tube or cross tube at the centre is known as "Levelling".

The bubble of longitudinal tube is centred with the help of rotation of foot screw while the bubble of cross tube is centred with the help of to and fro motion of tripod leg.

③ Removal of Parallax :→

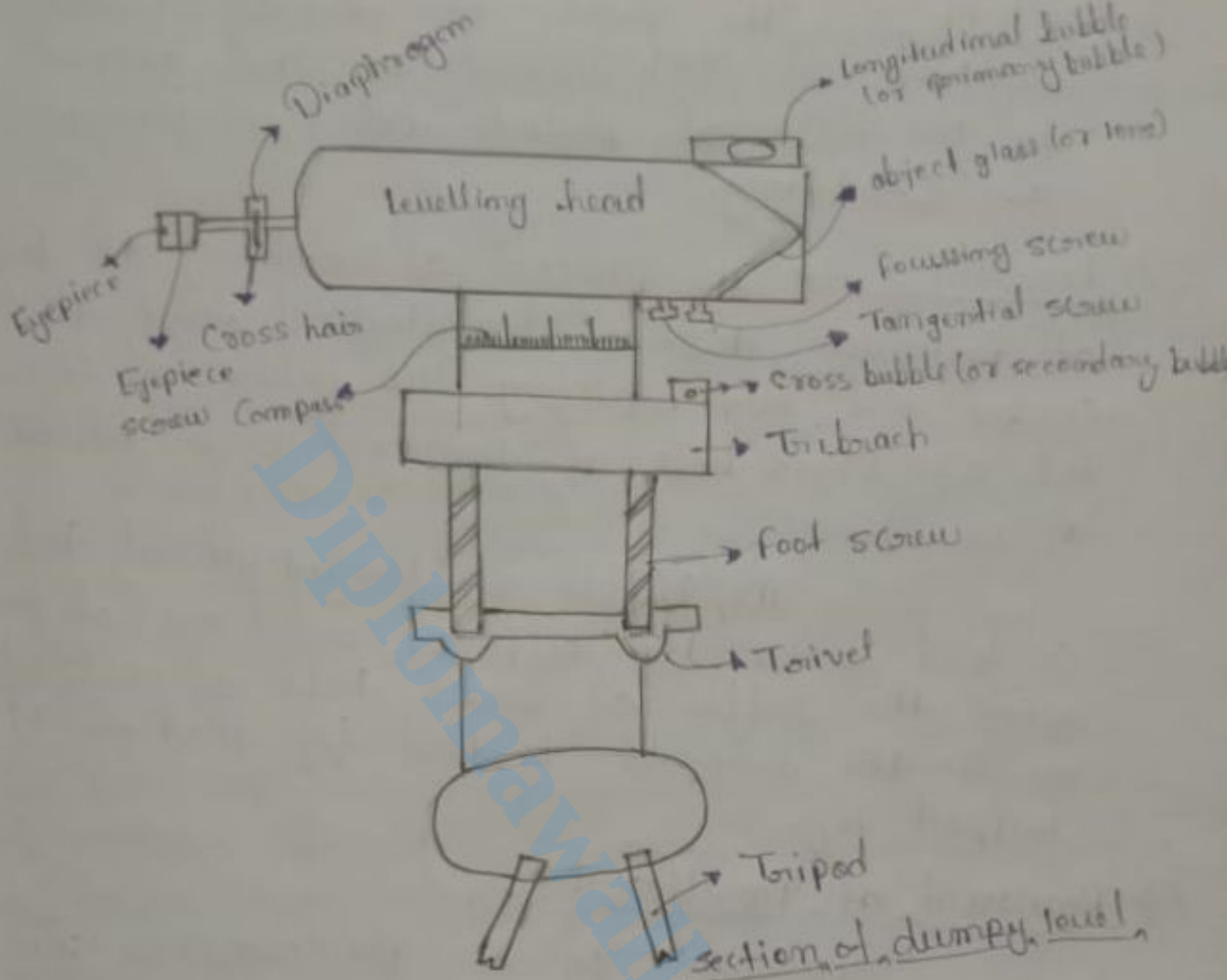
Parallax is the phenomena in which the image of the cross hair doesnot come into the plane of the image of the object.

Parallax is removed by the following two screw :→

(i) Eye piece screw :→ The image of cross hair get clear sharp by the help of this eyepiece screw.

(ii) Focussing screw :→ The image of object get sharp by the help of this focussing screw or object screw.

(ii) Construction and working of a Dumpy level :-



Section of dumpy level

(iii) Component of Dumpy level :-

1. Triped
2. Trivet
3. foot screw
4. Tribrach
5. Cross bubble or (secondary bubble)
6. Compass
7. Tangential screw
8. Focussing screw
9. object glass (or lens)
10. longitudinal bubble (or primary bubble)
11. Diaphragm
12. Cross hair
13. eye piece screw

25th DEC

(II) Method to find out the RLs of various points situated on the earth surface :→

V.V.I

① Line of collimation method (or HI method)→ Height of instrument method)

② Rise and fall method

① Line of collimation method (or HI method) :→ (Hight of instrument method) :→

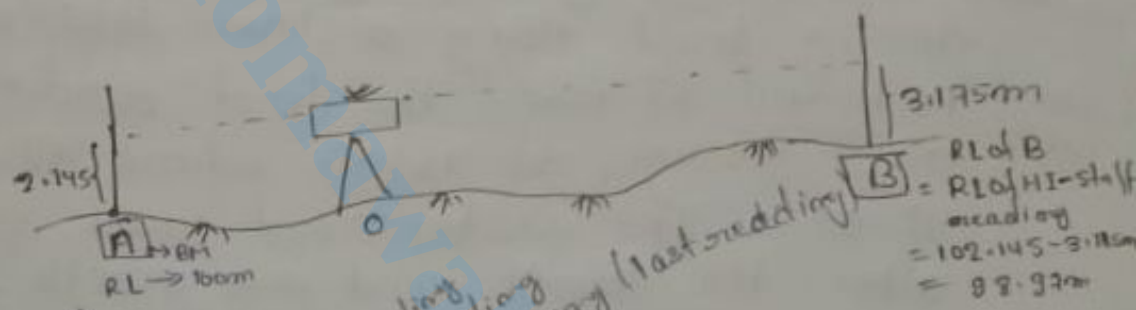
1st reading → Levelling staff → BM → Bench mark ⇓ It is the point of known RL

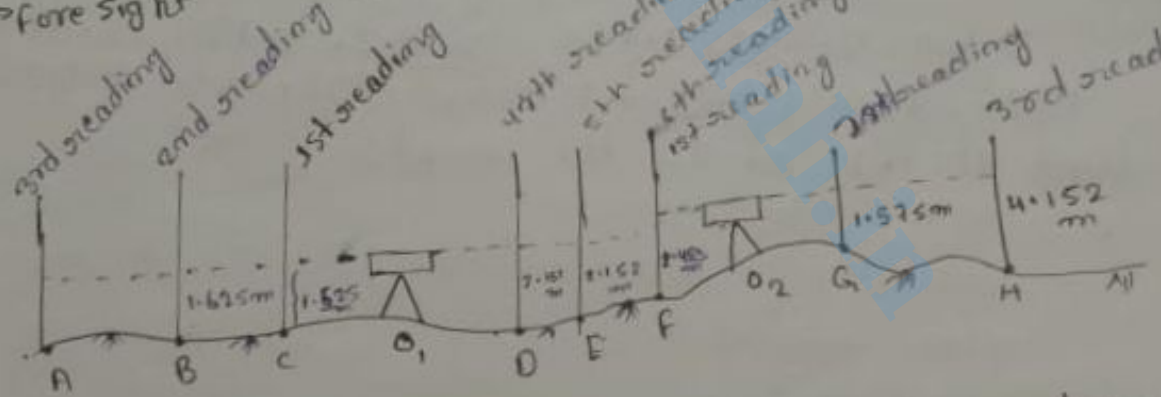
RL of HI = RL of BM + BS
= 100 + 2.145 = 102.145 m

Levelling staff reading

BS IS FS

(BS) = Back sight
(IS) = Intermediate sight
(FS) → Fore sight





Instrument position O_1 :→

1st reading → point C → BS
2nd reading → point B → IS
3rd reading → point A → IS
4th reading → point D → IS
5th reading → point E → IS
6th reading → point F → FB

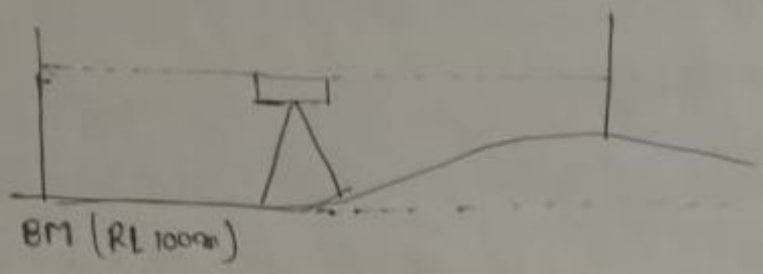
Instrument new position

1st reading → point F → BS
2nd reading → point G → IS
3rd reading → point H → FS

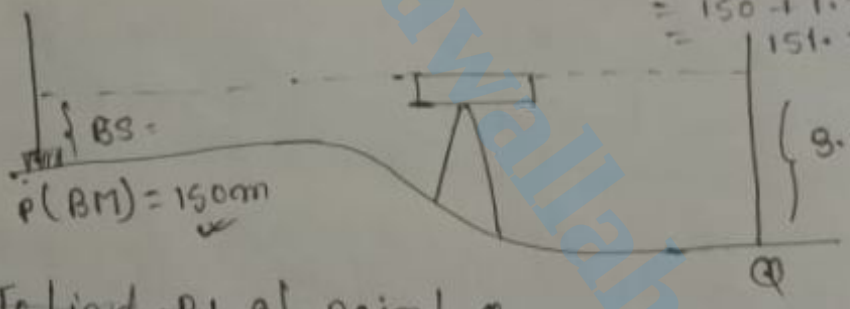
24th DEC

(#) RISE AND FALL METHOD :-

Concept Rise :-



(#) Concept of Fall :-



To find RL of point Q
= RL of point P - fall
= 150 - (-1.796m)
= 150 + 1.796
= 151.796

9.248

* To find RL of point Q

Preceading staff reading
- Succeading staff reading
= -ve ⟹ fall
= 1.452 - 3.248
= - 1.796m

(*) Conclusion too Rise and fall method :-

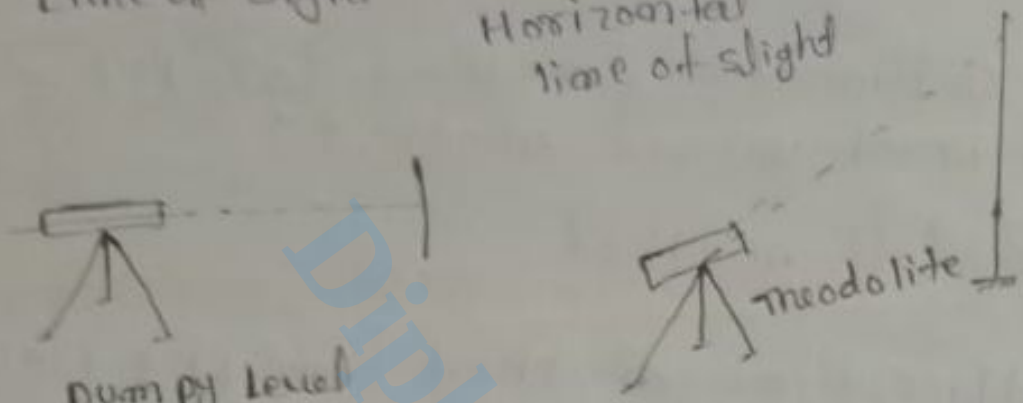
RL of 'y' point = RL of point just preceding to y ± Rise or fall of the given point y

Important terminology :→

Line of collimation
Line of sight

Line of sight may be horizontal or inclined

Horizontal line of sight



(*) **LINE OF SIGHT :→** The imaginary line passing through the optical centre of object glass and it's continuation.

Ques: The following readings were taken with a dumpy level along a chain line at common interval of 15m. The first reading was at a chainage of 165m where the RL is 98.085. The instrument was shifted after the fourth and ~~orig~~ ninth readings.

3.150, 2.215, 1.125, 0.860, 3.125, 2.760
1.835, 1.470, 1.965, 1.225, 2.890, and 3.035

find the RLs of all the points

Continuation line

4/01/2025

Chapter - Countouring

(#) Definition :→ Contour may be defined as an imaginary line joining the points of same RL on the earth surface.

↳ The height or elevation of various points with respect to MSL ⟹ RL of that point

↳ AJPMGA

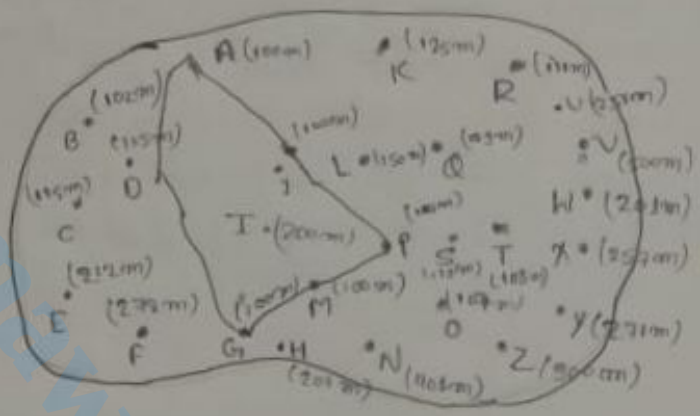
↓

Closed figure

↓

Closed contour

↳ AJ → Contour line
JP → Contour line
PM → Contour line
MG → Contour line
GA → Contour line



(#) Significance of Contour :→ (Need)

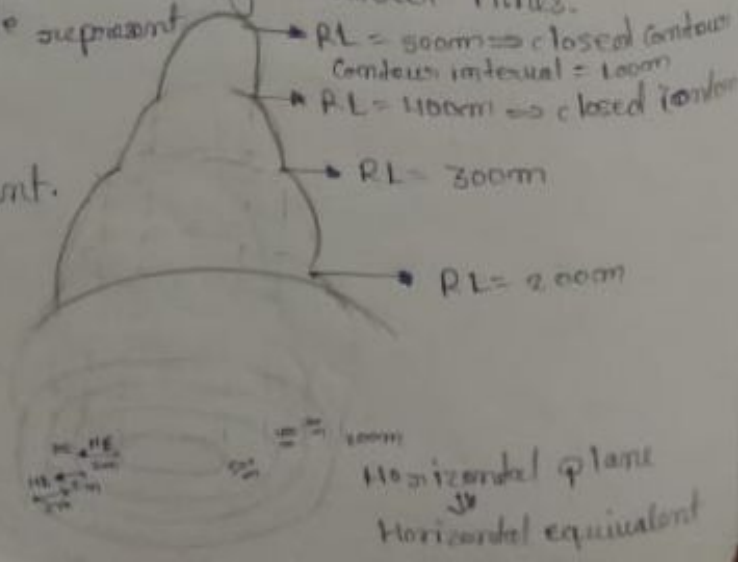
↳ By plotting the contour lines, we can prepare a Contour map.

↳ Contour map is a 3-D map.

↳ Contour map → Map containing contour lines.

↳ Higher value inside represent "Hill".

↳ Contour interval
horizontal equivalent.



Arithmatic check :- (Rise and fall method)

$\Sigma BS - \Sigma FS = \Sigma Rise - \Sigma fall = Last\ RL - First\ RL$

$\Rightarrow 7.48 - 7.25 = 5.125 - 4.895 = 103.795 - 103.565$

$\Rightarrow 0.23 = 0.23 = 0.23$

Checked.

Ques The following consecutive readings were taken with a levelling instrument at intervals of 20m.

2.375, 1.730, 0.615, 3.450, 2.835, 2.070, 1.835, 0.985, 0.435, 1.630, 2.255 and 3.630m. The instrument was shifted after the fourth and eight readings. The last reading was taken on a BM of RLL 110.200 m. Find the RLs of all the points.

If 'y' point is at Rise

RL of 'y' point = RL of point just preceeding to y + Rise

If 'y' point is at fall

RL of 'y' point = RL of point just preceeding to y − fall

Ques: The following successive reading were taken with a dumpy level along a chain line at common intervals of 20m. The first reading was taken on a chainage 140m. The RL of the second change point was 107.215m. The instrument was shifted after the third and seventh reading Calculate the RLs of all the points.

3.150, 2.245, 1.125, 3.860, 2.125, 0.760, 2.235, 0.470, 1.935, 3.225, and 3.890m

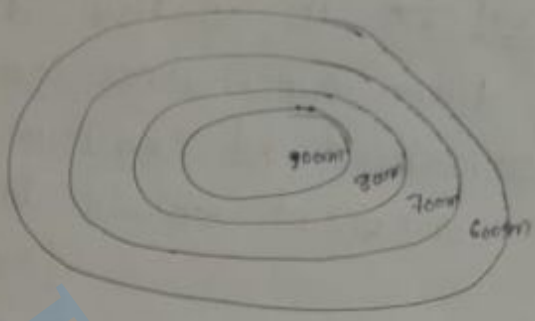
(3.860 — BS; 2.235 — BS)

Chainage	BS	IS	FS	Rise	Fall	RL of various points	Remarks
140	3.150			0.905		? = ?? 103.565	
160		2.245		0.905		? = ?? 1011.47	
180	3.860		1.125	~~1.735~~ 1.33		2 = ?? 105.59	1st CP
200		2.125		1.795 ~~1.365~~		y = ?? 107.825	
220		0.760		1.365	1.475	x = ?? 108.63	2nd CP
240	0.470				1.475 1.465	107.215	
260		1.935			1.465 1.29	107.215 − 1.465 = 105.75	
280		3.225			1.29 0.665	105.75 − 1.29 = 104.46	
300			3.890		0.665	104.46 − 0.665 = 103.795	
	Σ BS = 7.48		Σ FS = 7.25	Σ Rise = 5.125	Σ fall = 4.895		

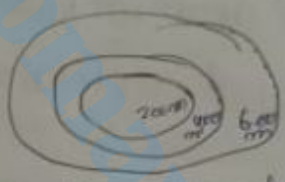
Unit-VI

(11) Characteristics of a Contour :→

(1) Closed contour having higher value inside represent a hill.



(2) Closed contour having lower value inside represent a Depression.

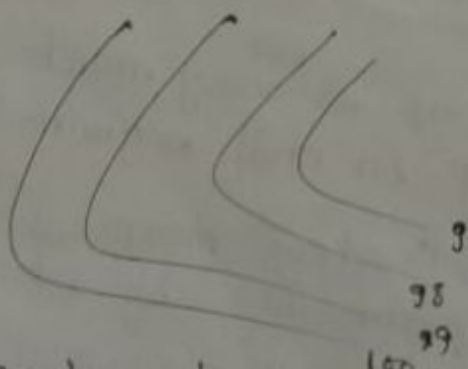


(3) Contour may be closed or open.

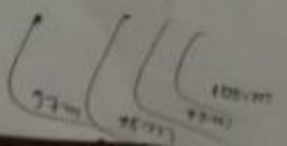
(4) open contour having lower value inside represent valley line.

valley (घाटी) :→ दो पहाड़ों के बीच का समतल रास्ता।

pass (दर्रा) :→ दो पहाड़ों के बीच का खाली रास्ता



(5) open contour having higher value inside represent Ridge line (peak point) जिसका उल्टा होगा।

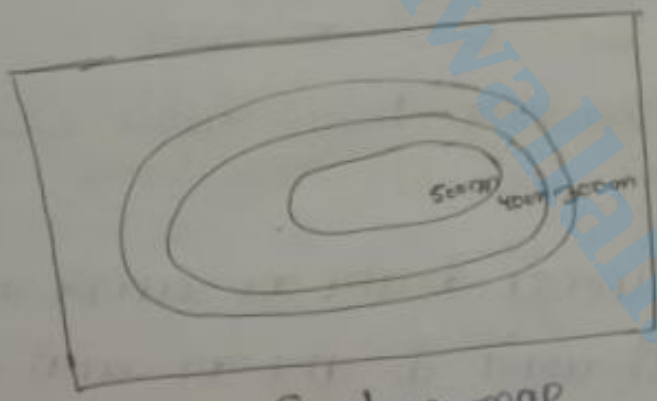


↳ **Horizontal equivalent** :→ The horizontal distance between between any two consecutive (continuous) contours for the horizontal equivalent horizontal measurement should be done.

↳ **Contour interval** :→ The vertical distance between any two consecutive contours for the measurement of contour interval vertical measurement should be done.

Ques → Why Contour map is known as 3-D map?

→ By the help of Contour map, we are in position to demonstrate (explain) the three dimensional orientation.

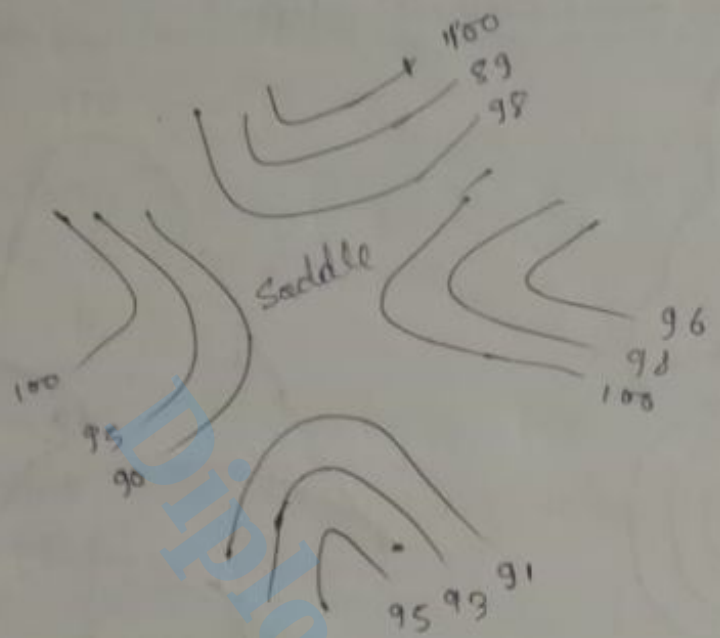


Contour map

Ques:→ Why Contour map is very much important or essential map in civil engineering?

Ans It is because Contour map is only a map in civil engineering by which we demonstrate the three dimensional orientation of a particular structure.

(8) Depression between the summit (Ridge) is known as "Saddle".



(9) Uniformly spaced contours lines indicate uniform slope.

uniform slope ⟹ slope constant

⇓

$m_1 = m_2 = m_3 = \tan\theta$

uniformly spaced contour

⇓

Contour interval constant

100

99

98

(10)

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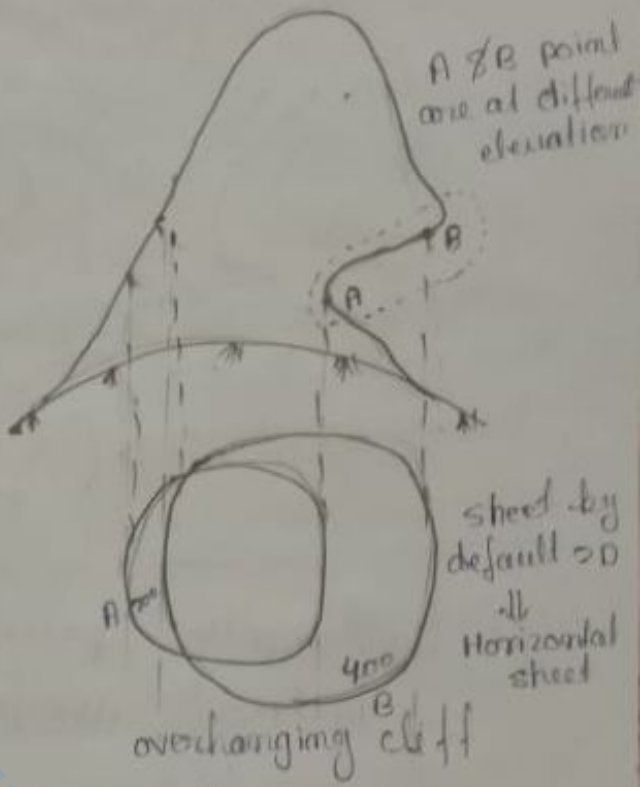
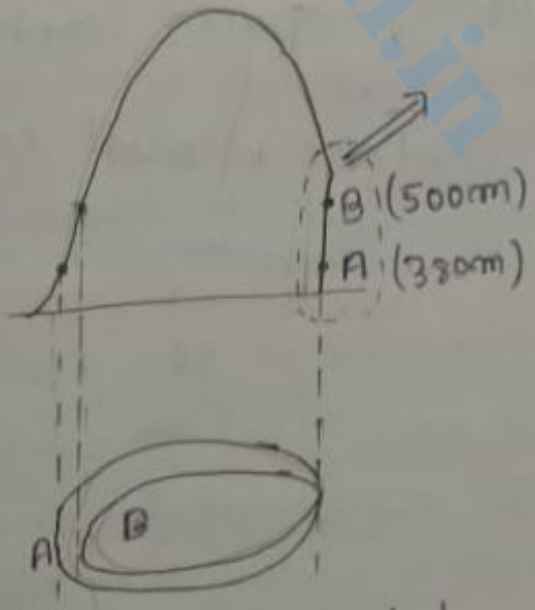
⑥ Contour lines does not cross each other except in case of overhanging cliff.



overhanging cliff

⑦ Contour lines does not meet at the same point except in case of vertical cliff.



2D Horizontal Sheet

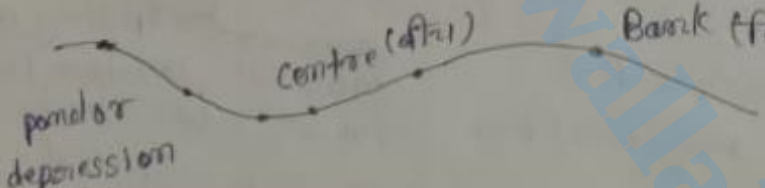
In case of Depression or pond :→

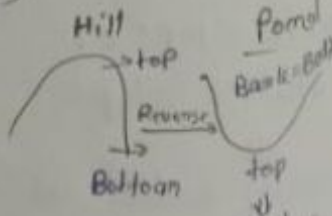
(i) Nature of slope at centrical of the pond
→ Gentle or flatter

(ii) Nature of slope at bank of the pond
→ steeper

(iii) Nature of Contours lines at center of the pond
→ Widely spaced

(iv) Nature of the Contour lines at bank of the pond
→ closely spaced





JUI Q.w Write down the characteristic Contour lines.

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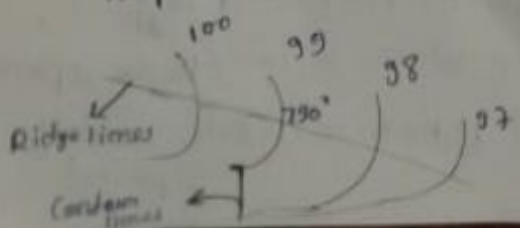
(ii) Ridge line and valley lines :→

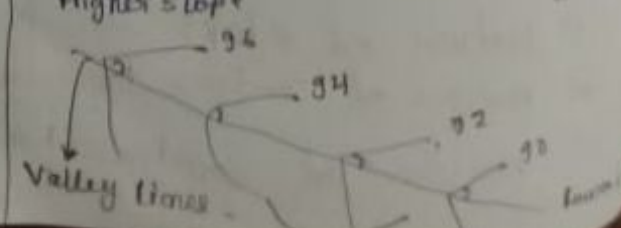
RIDGE LINE

↳ Higher value inside a top loop → Contours

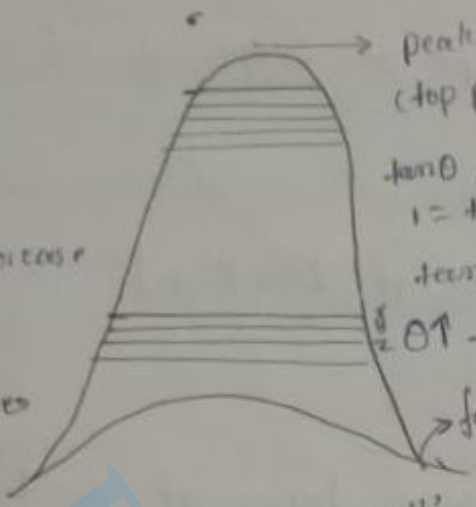


VALLEY LINES

↳ Lower value inside a loop of contours



(10) Hill or high raise ground



slope

Increase Decrease

* top portion of hill = steeper slope

* Bottom portion of the hill = Gentle or flatter slope

$\tan\theta$, $\tan 30^\circ = \frac{1}{\sqrt{3}}$

$1 = \tan 45^\circ$, $\tan 60^\circ = \sqrt{3}$

$\tan 90^\circ = \infty$

$\theta \uparrow \rightarrow \tan\theta \uparrow$

tan = tangent

curve portion

top of the hill ⇓ steeper slope

$\theta_1 < \theta_2 < \theta_3$ → steeper slope

$m_1 < m_2 < m_3$

⇓ gentle slope or flatter slope ⇓ gravity action is very lesser.

⇓ gravity action is very much high

fluctuation

Contour interval (min^m) → Horizontal equivalent (max^m) → spacing of contour lines are closely spaced

Bottom of hill ⇒ flatter slope ⇓ points fluctuation

fluctuation

Contour interval (min^m) → Horizontal equidant (max^m) → spacing of contour lines are widely spaced

V.V.I

CONCLUSION

In case of a hill or high raise ground :-

(i) Nature of slope at top of the hill = steeper

(ii) Nature of slope at bottom of the hill = flatter or gentle

(iii) Nature of contour lines at top of the hill = closely spaced

(iv) Nature of contour lines at bottom of the hill = widely spaced.

Contour gradient = $\frac{\text{contour interval}}{\text{Horizontal equivalent}}$

We are finding the contour gradient between 99m contour and 98m contour.

Contour gradient = $\frac{1}{200}$ = or 1 in 200

$= \frac{1}{200} \times 100 = 0.5\%$

Contour gradient meaning :→

एक contour दूसरे contour के साथ कितने के दाल पर है।

Count Contour gradient = $\frac{\text{Numerater}}{\text{Denominater}}$

$= \frac{\text{Contour interval}}{\text{Horizontal equivalent}}$

Mathematically,

Contour gradient may be defined as the ratio of contour interval to the horizontal equivalent.

V.V.I

Method of Locating Contour :→

- Direct method
  - Direct method-I
  - Direct method II
- Indirect method
  - By square method
  - By cross Section method.

CONTOUR GRADIENT :→

Contour + Gradient → Contour gradient

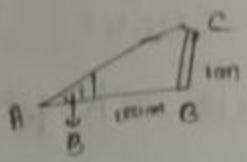
Gradient → slope ⇒ Represent in "θ"

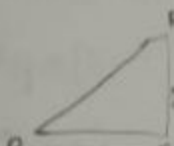
Represent in "1 in n"

Format

1 in "n"

NOTE :- Sometimes gradient is expressed in percentage





Vertical rise or fall (Constant)

Horizontal Distant (Variable)

slope - m = tanθ = B/AB

⇒ tanθ = 1/100 ⇒

⇒ slope ⇒ θ

θ = tan⁻¹(1/100)

⇒ m = 1/100 ⇒ slope

slope → θ = tan⁻¹(1/100)

Gradient → 1 in n

= 1/100 = 1/100 × 100

Gradient = 1%

meaning :→

100 m horizontal distance pr ground 1 m rise hai

Gradient

1m = 100

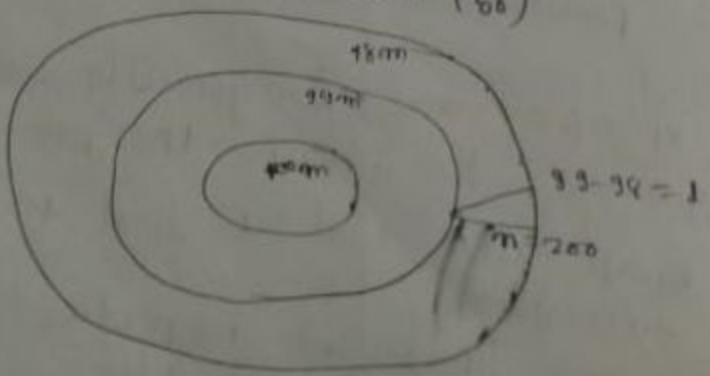
Ques Gradient = 2%

= 1/50 × 2/100 = 1 in 50

= 2%

slope ⇒ θ = tan⁻¹(1/50)

Let us assume the horizontal equivalent of 99m contour 98m is 200m.



↳ Ridge lines and to Contours lines cross each other at 90°

↳ with respect to higher slope curve is of Concave shape

↳ Loop shape U shaped

↳ with respect to lower slope, curve is of Convex shape

↳ Valley lines and Contours lines cross each at 90°

→ with respect to higher slope, curve is of convex shape

↳ Loop shape → V-shaped

↳ with respect to lower shaped curve is of Concave shape.

(11) Application or use of Contour or Contour map :→

VV-I

① Contour map gives the actual topography of a particular region.

② Contour map gives 3 dimensional plan.

③ Contour map is very much essential for preparing any civil engineering project such as pavement design, Dams, flyover etc.

④ Contour maps are frequently used by the civil engineers to finish the project.

⑤ Contour maps are used to find the storage capacity. reservoirs.

⑥ Contour map plays an important role in the study of hilly region and valley region.

Direct method - I

- When the given area is too large and cannot be controlled by a single station

⇓

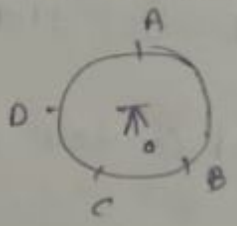
Single station की outer boundary को fixed नहीं कर पाएँगे।

Direct method II

- When the given area is small and can be controlled by a single station.

⇓ means

Single station की outer boundary fixed कर सकते हैं।



DIRECT METHOD I →

Target :- You have to draw a contour of 101m or you have to locate a contour of 101m on the ground and also represent it on the drawing sheet.

(#) INDIRECT METHOD :-

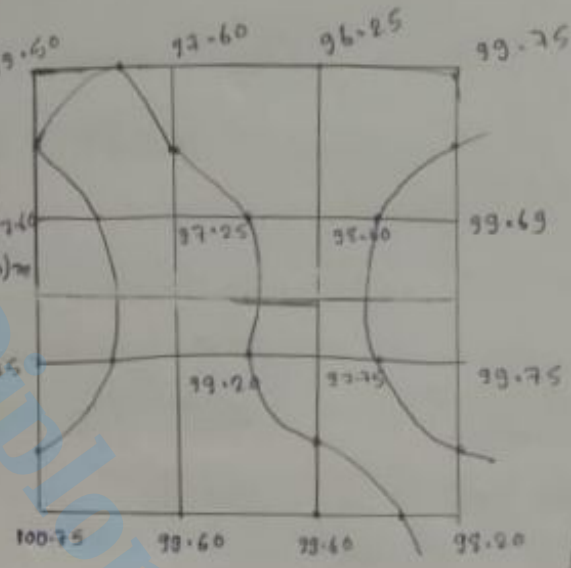
- By Square method
- By Cross Section method

By Square method :-

Locate of Contour having RL = 99m

Side of each square varies between = (5 to 20)m

Let consider side of each square = 10m



$\because (99.20 - 98.75) \longrightarrow 10$

$\therefore 1 \longrightarrow \frac{10}{(99.20 - 98.75)}$

$\therefore (99 - 98.75) = \frac{10}{(99.20 - 98.75)} \times (99 - 98.75)$

$= 5.56\text{m}$ from 98.75

$\because (100.75 - 98.75) \longrightarrow 10$

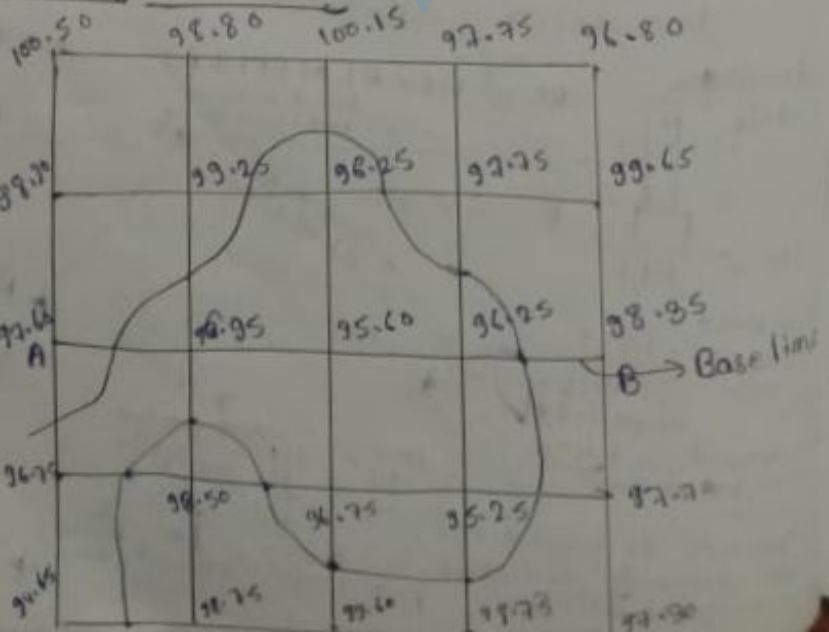
$\therefore 1 \longrightarrow \frac{10}{(100.75 - 98.75)}$

$\therefore (99 - 98.75) = \frac{10}{(100.75 - 98.75)} \times (99 - 98.75)$

$= 1.25\text{m}$ from 98.75

(#) By Cross Section method :-

Locate the Contour 97m



THE END

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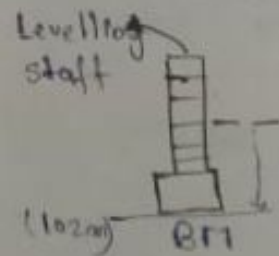
METHOD OF LOCATING CONTOUR :→

Direct method → [Direct method I
Direct method II

Direct method :→ You have to locate a contour of RL 103m on the ground and also represent it on the drawing sheet.

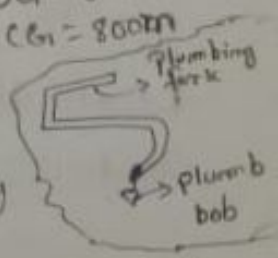


RL of HI = RL of BM1 + BS
= 102 + 2.250m
= 104.250m

BS = 2.250m

L → position of Dumpy level

AG = 200mm DG = 600mm
BG = 400mm CG = 800mm



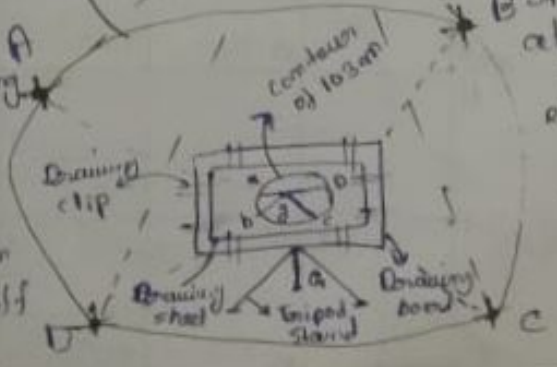
Contour of RL of 103m

RL of point A = 104.250 − 1.250 = 103m

Staff reading at point A = 1.250

B Staff reading at point B = 1.250

RL of point B = 104.250 − 1.250 = 103m



where,
G → Ground position of plan table
g → position of ground on the drawing sheet staff reading at point D = 1.250

scale → 2000mm = 2cm
ag = 2cm dg = 6cm
bg = 4cm cg = 8cm
Staff Reading at point C = 1.250