(8)

UNIT - II

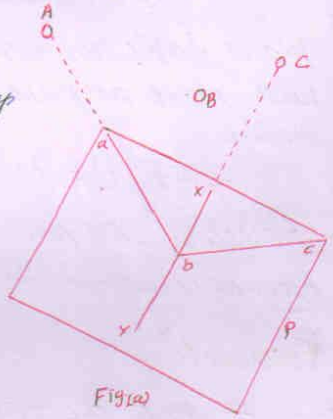
16 Mark

1. Explain briefly the following method of solution of three point problem. (i) Bessel's Graphical method (ii) Trial and error method.

(i) Bessel's Graphical method

*1 After having set the table at station P. Keep the alidate on ba and rotate the table so that A is bisected clamp the table

*2 Pivoting the alidate about b, sight to C and draw the ray xy along the edge of the alidate. [Fig:a]

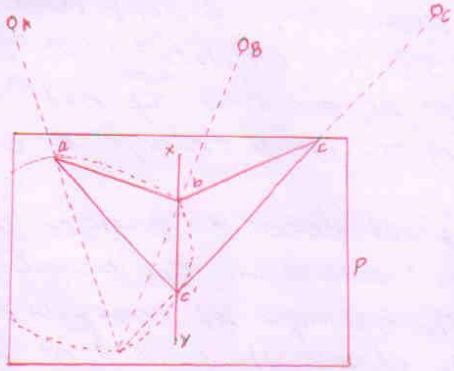


Fig(a)

*3 Keep the alidate along ab and rotate the table till B is bisected. clamp the table.

*4 Pivoting the alidate about a sight to c. Draw the ray along the edge of the alidate to intersect the ray xy in c'. [Fig:b]. Join cc'.

*5 Keep the alidate along c'c and rotate the table till c is bisected. clamp the table the correctly oriented.



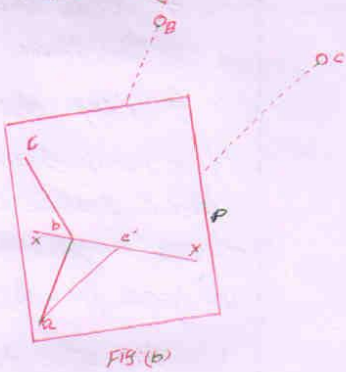


Fig (b)

*6 Pivoting the alidate about b, sight to B. Draw the ray to intersect cc' in P. Similarly if alidade is pivoted about a and A is sighted, the ray will pass through P. if the work is accurate.

* The point a, b, c' and p form a quadrilateral and all the four points lie along the circumference of a circle. Hence this method is known as Bessels method of Inscribed quadrilateral

Trial and Error method.

* In this method, the orientation is done by trial and error method. This method was given by a well known mathematician, Lehmann and hence this method is also known as Lehmann's method. It is quick and accurate method

* This method is based upon the principle that if the plane table is oriented, the resectors through a, b and c. will meet at point p which is the location of the plane table station.

* If the table is out of orientation then the resectors will not meet at a point and they will form a triangle which is known as triangle of error.

Procedure:

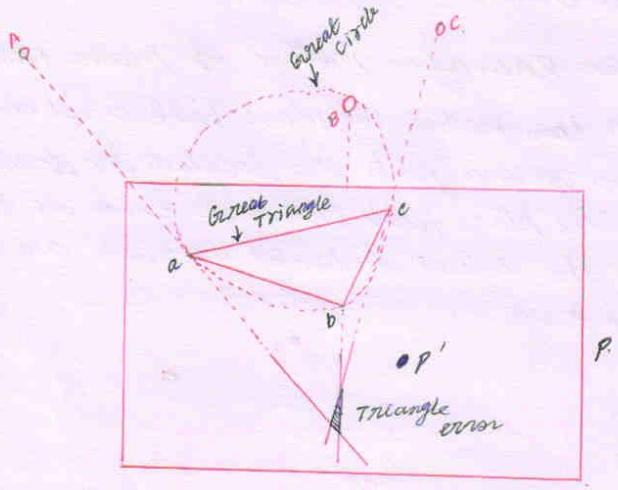
*1 Set the table at P and orient the table approximately so that 'ab' is parallel to AB. Clamp the table.

*2 Keep the alidade pivoted about 'a' and sight A. Draw the ray. Similarly draw rays from b and c towards B and C respectively. If the orientation is correct the three rays will meet at one point. If not, they will meet in three points forming one small triangle of error.

*3 The triangle of error so formed will give the idea for the further orientation. The orientation will be correct only when the triangle of error is reduced to one point. To do this, choose the point P' as shown in Fig:

*4 Keep the ~~Ale~~ alidade along P'a and rotate the table to sight A. clamp the table. This will give next approximate orientation.

*5 Keep the alidade at 'b' to sight B and draw the ray. Similarly, keep the alidate at c and sight c Draw the ray.



*6 These rays will again meet in one triangle the size of which will be smaller than the previous triangle of error. If P' has been choosen judiciously keep in the view the lehmann's Rules.

*7 Thus by successive trial and error the triangle of error can be reduced to a point.

⇒ The final and correct position of the table will be such that the rays Aa, Bb and Cc meet in one single point, giving the point P.

⇒ The line joining A,B,C (or a,b,c) form a triangle known as the great triangle.

⇒ Similarly the circle passing through A,B,C or (a,b,c) is known as the great circle.

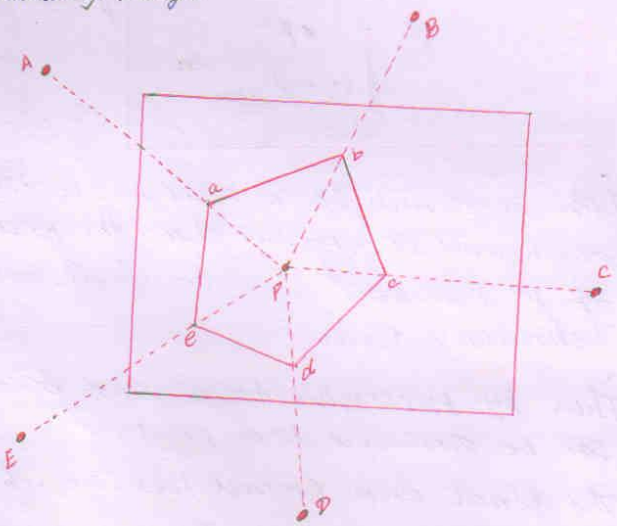
Lehmann's rules.

* If the station P is outside the great triangle ABC the triangle of error will also fall outside the great triangle and the P' should be choosen outside the triangle error.

* If the station P is inside the great triangle the triangle of error will also be inside the great triangle and the point P should be chosen inside the triangle of error

2.a) Explain Radiation method of plane tabling May-2014

* In this method the plane table is set out on one location and various points are located by drawing radiating rays from the plane table station to each of the point and plotting the actual distances to scale on the corresponding rays.



Following is the Procedure.

*1 The plane table is set up on a station P. such that all the points A,B,C,D and E on the ground are visible

*2 The north line is drawn on the right hand top corner of the drawing sheet using trough (or) box compass

*3 With the alidade touching point P, the ranging rods at A,B,C,D and E are bisected and the rays are drawn.

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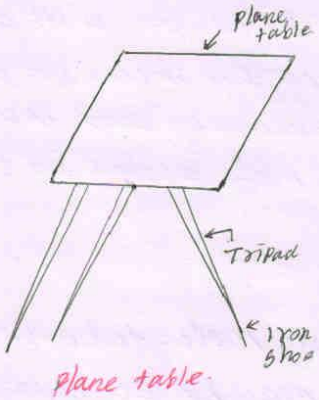
* The distances PA, PB, PC, PD and PE are measured by a tape (or) chain and the distances are plotted on the respective rays to a suitable scale.

The radiation method is useful for surveys of small areas wherein all the objects can be commanded from a single plane table station. In large-scale areas to be surveyed this method can be continued with other methods. Using a telescopic alidade the work can be rapidly used and will have a wider scope.

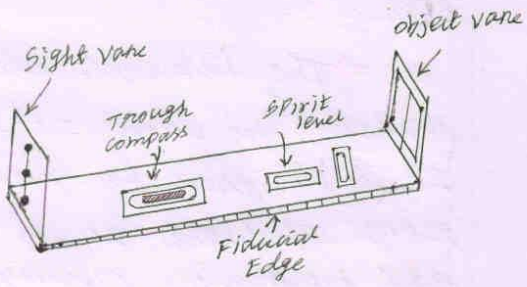
2.b) Explain in detail the accessories used in plane tabling with purpose.

Drawing Board:

* The drawing board is made of well-seasoned woods. The size vary as 40cm x 30cm to 75 cm x 60 cm or 50 cm. to 60 cm square. It base is mounted on a tripad with adequate adjustments for levelling, verticality and clamping.



Plane table



Alidate

Alidade:

* An Alidate is a straight edge with some form of sighting device. It is used for sighting the object and drawing the lines. The following two types of alidade are in general use.

* plain alidate
* Telescopic alidate

⇒ The plain alidade consist of a metal or wooden rule with two vane at the ends which can be folded on the rule when alidade is not in use. the vane provided with a narrow slit with three holes is the sight vane and the other one carrying a hair, a fine thread or thin wire the object vane.

⇒ The line passing through the sight vane slit and thread in the object vane both contained in a plane, defines the line of sight which will be parallel to the ruling edge, known as fiducial edge of the alidade.

⇒ The alidade can be rotated about the points which represent the plane table station on the sheet, so that the line of sights passes through the station sighted.

⇒ The telescopic alidade provided with a telescope replaces the vanes. It is used for inclined sights. It is designed for greater accuracy and increased range of sights. It is extremely useful for contouring and topographic surveys.

Spirit level

* It consist of a small metal tube which contains a small bubble. It may be circular or tubular but its base must be flat so that it can be laid on the table.

* A spirit level is used to check that the plane table is properly levelled. Levelling is checked by placing the spirit level on the board in two position.

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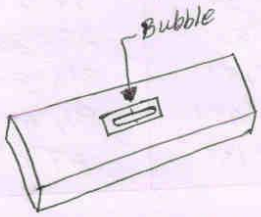
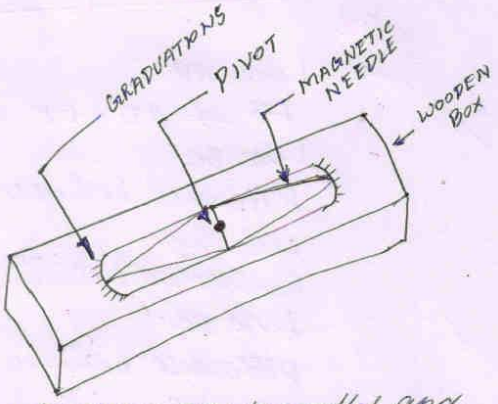
at right angles to each other. The table is truely levelled when the bubble remains central all over the table.



Magnetic Compass.

In plane tabling, a trough compass is used to orient the plane table to magnetic north. It consists of long, narrow. the magnetic needle rests on a pivot at the centre of the box.



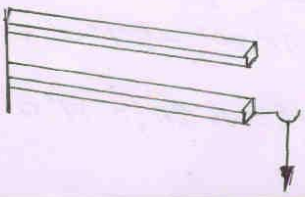
The longer sides of the compass are parallel and plane so that they can be used as a ruler for drawing the north direction or for placing the compass along an already drawn line indicating the magnetic north.

Plumbing Fork:

It consist of a hair pin-shaped brass or wooden frame having two arms of equal length. one end has a pointer while a plumb bob is attached to the other end.

The plumbing fork is used in large scale surveys for accurate centering of the plane table over the ground station.

It is also used for transferring the location of the plotted instrument station position on to the ground.



3. Find which stations are affected by local attraction workout correct bearing of closed traverse ABCDEA

Line	FB	BB
AB	190°30'	17°0'
BC	73°30'	250°30'
CD	36°15'	214°30'
DE	266°45'	84°45'
EA	234°15'	57°0'

Sol.

Line AB
FB of AB - BB of AB = 173°30'
Line BC
Difference between FB and BB = 177°0'
Line CD
Difference between FB and BB = 178°15'
Line DE
Difference between FB and BB = 182°0'
Line EA
Difference between FB and BB = 177°15'

From the difference between FB and BB, we conclude that there is no line whose FB and BB differ by 180°. But the FB and BB of line CD differ by 178°15' the difference is only -1°45' Hence the.

Corrected F.B of CD = 36°15' - 0°52'30"
= 35°22'30"

Corrected BB of CD = 214°30' + 0°52'30"
= 214°22'30"

Difference between F.B and B.B = 180°0'

Calculation of Interior angle.

Bearing of AF = 57°0'
Bearing of = 190°30'
∠A = 190°30' - 57°0' = 133°30'
∠B
Bearing of BA = 17°0'

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Bearing of BC = 73°30'

$\angle B$ = 73°30' − 17°0'
= 56°30'

$\angle C$:

Bearing of CB = 250°30'
Bearing of CD = 35°22'30"

Exterior angle, $\angle C$ = 215°7'30'
Interior angle = 360° − 215°7'30"
= 144°52'30"

$\angle D$:

Bearing of DC = 215°22'30"
Bearing of DE = 266°45'
$\angle D$ = 51°22'30'

$\angle E$:

Bearing of ED = 84°45'
Bearing of EA = 234°15'
$\angle E$ = 234°15' − 84°45'
= 149°30'

$\angle A + \angle B + \angle C + \angle D + \angle E$ = 133°30' + 56°30' + 144°52'30"
+ 51°22'30" + 149°30"
= 535°45'0"

Sum of angles = (2n − 4) × 90°
= (2×5 − 4) × 90°
= 540°

Error = $\frac{4°15'0"}{5}$ = + 0°51'

Corrected Interior angle

$\angle A = 133°30' + 0°51' = 134°21'$

$\angle B = 56°30' + 0°51' = 57°21'$

$\angle C = 144°52'30'' + 0°51' = 145°43'30''$

$\angle D = 51°22'30'' + 0°51' = 52°13'30''$

$\angle E = 149°30' + 0°51' = 150°21''$

$\angle A + \angle B + \angle C + \angle D + \angle E = 134°21' + 57°21' + 145°43'30'' + 52°13'30'' + 52°13'30'' + 150°21'$

$= 540°0'$

Corrected Bearings:

BB of CD = 215°22'30''

FB of DE = BB of CD + $\angle D$

= 215°22'30'' + 52°13'30''

FB of DE = 267°36'

BB of DE = 267°36' − 180° [BB of DE − 180°]

= 87°36'

FB of EA = BB of DE + $\angle E$

= 87°36' + 150°21'

FB of EA = 237°57'

BB of EA = 237°57' − 180°

= 57°57'

FB of AB = BB of EA + $\angle A$

= 57°57' + 134°21'

= 192°18'

FB of AB = 192°18'

BB of AB = FB of AB − 180°

= 192°18' − 180°

= 12°18'

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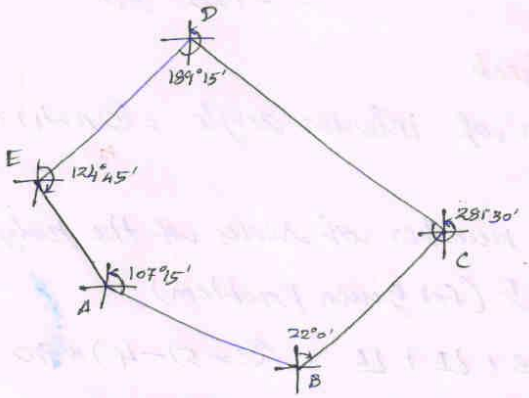
4. The bearing of the sides of a closed traverse ABCDEA are as follows.

SIDE	FORE BEARING	BACK BEARING
AB	107°15'	287°15'
BC	22°0'	202°0'
CD	281°30'	101°30'
DE	189°15'	9°15'
EA	124°45'	304°45'

Compute the interior angle of the traverse.

Sol:-



Included angle of LA = Bearing of AE - Bearing of AB

For clockwise direction. But the given traverse is in anticlockwise direction, Hence the formula has to be changed as follows.

Included Angle of LA = Bearing AB - Bearing of AE

Interior Angle LA = 107°15' - 304°45'

= -197°30'

(Add 360°) LA = -197°30' + 360°

= 162°30'

Interior Angle LB = Bearing of BC - Bearing of BA

= 22°0' - 287°15'

= -265°15'

(Add 360°) LB = -265°15' + 360°

= 94°45'

Interior angle $\angle C$ = Bearing CD - Bearing of BC
= 281°30' - 202°0'
= 79°30'

Interior angle $\angle D$ = Bearing of DE - Bearing of CD
= 181°15' - 101°30'
= 79°45'

Interior Angle $\angle E$ = Bearing of EA - Bearing of ED
= 124°45' - 1°15'
= -123° 30'.

Arithmetic Check

Sum of interior angle = $(2n-4)\times 90$

where

n - number of sides of the polygon

and n - 5 (for given problem)

$\angle A + \angle B + \angle C + \angle D + \angle E = ((2\times 5)-4)\times 90$

$162°30' + 94°45' + 79°30' + 79°45' + 123°30' = 6\times 90$

$540° = 540°$

Note: Bearing of BA = Back Bearing of AB
Bearing of ED = Back Bearing of DE, etc.

5. Discuss the merits and demerits of plane tabling. (NOV- 2006, 2010, 2011, 2012)

Advantages of plane table surveying:

*1 Plotting is carried out in the field itself and hence chances of omitting any measurement are avoided

*2 plotted details are checked easily

*3 No office work for plotting

*4 Less number of control point are required

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*5 Irregular details and contours can be done accurately as the entire area remains in view during survey.

*6 Error due to reading, recording and plotting are completely eliminated

*7 the principles of intersection and resection are conveniently used to avoid computation

*8 It is an in-expensive method

*9 It is most suitable for small scale maps

*10 It is most suitable for magnetic areas, where a compass survey is not reliable.

Disadvantages of plane table surveying:

*1 The time required to survey the area in the field is comparatively high.

*2 This method can be used only in the open field with higher visibility

*3 Heavy summer and rainy season affect the progress of survey work.

*4 It is difficult to carry the accessories of plane tabling in the field.

*5 It is not suitable where higher accuracy is required.

UNIT II – COMPASS SURVEYING

1. Distinguish between angle and bearing? (May / June 2012)

- An angle is defined as the deviation of one straight line with respect to the other one.
- Bearing is defined as the angle (or) inclination of a survey line with respect to the north-south direction.

2. Define true meridian. (Nov/Dec 2012) (Nov/Dec 2010)

- True meridian (or) Geographical meridian is defined as the line joining the geographical north and south poles. True meridian at various places are not parallel to each other.

3. What is magnetic meridian? (Nov/Dec 2009)

- Magnetic Meridian is defined as the longitudinal axis, indicated by the freely suspended, properly balanced magnetic needle. It does not coincide with the true meridian except in certain places during the year.

4. Define Local Attraction

- The deflection of the magnetic needle from its normal position due to attraction of magnetic materials such as magnetic rocks, iron ores, electrical cables etc., is called Local Attraction.

5. What are sources of local attractions? (Nov/Dec 2006)

✓ Magnetic materials such as magnetic rocks, iron ores, electrical cables etc., are sources of local attractions.

6. If the magnetic bearing of a line AB is 134o45', find its true bearing if the magnetic declination is 10o15'. (Apr/May 2008)

True Bearing = Magnetic Bearing + Declination
= $134^{o}45' + 10^{o}15'$
= 145^{o}

7. Define the term Dip. (Nov/Dec 2011) (Apr/May 2011)

✓ The inclination of the magnetic needle with the horizontal plane is called Dip (or) Angle of Dip. The angle of dip at equator is 0^{o} and it increase when approaching the poles. It becomes 90^{o} at poles.

8. What is Magnetic declination? (Nov/Dec 2010) (Nov/Dec 2012)

✓ Magnetic Declination is defined as the horizontal angle between the true north and magnetic north at a place, at the time of observation. The magnetic needle can either be deflecting, towards east (or) west of the true meridian.

9. Define Declination and Dip in compass surveying? (Nov/Dec 2006) (Nov/Dec 200

✓ The inclination of the magnetic needle with the horizontal plane is called Dip (or) Angle of Dip. The angle of dip at equator is 0^{o} and it increase when approaching the poles. It becomes 90^{o} at poles.

✓ Magnetic Declination is defined as horizontal angle between the true north and magnetic north at a place, at the time of observation. The magnetic needle can either be deflecting, towards east (or) west of the true meridian.

10. Differentiate between Magnetic declination and Dip? (Nov/Dec 2009)

✓ The inclination of the magnetic needle with the horizontal plane is called Dip (or) Angle of Dip. The angle of dip at equator is 0^{o} and it increase when approaching the poles. It becomes 90^{o} at poles.

✓ Magnetic Declination is defined as the horizontal angle between the true north and magnetic north at a place, at the time of observation. The magnetic needle can either be deflecting, towards east (or) west of the true meridian.

✓

12. How the surveyor's compass is graduated? (Nov/Dec 2009)

Surveyor's compass is graduated from 0^{o} to 90^{o} from North and South. At North and South 0^{o} 0^{o} to 90^{o} East and West 90^{o} is marked.

2 Marks with answers

13. Convert the following WCB into RB (a) 112°04' (b) 339°42' (Nov/Dec 2009)

(a) RB of 112°04' = 180- 112°04'= S 67°56' E

(b) RB of 339°42' = 360- 339°42'= N 20°18' W

14. Convert the following WCB into RB. (a) 151° 20' (b) 332° 40'

(Apr/May 2011)

(a) RB of 151°20' = 180 - 151°20'= S 28°40' E

(b) RB of 332°40' = 360 - 332°40'= N 27°20' W

15. The bearing of a line PQ is N 50□25' E. What is its whole circle bearing? (Nov/Dec 2006)

The bearing of given line PQ is N 50°25' E. It lies in the first quadrant and hence, its whole circle bearing is also 50°25'

16. Convert the following RB into WCB (a) S 34□42' E (b) N 02o18' W

(May / June 2007)

(a) WCB of S 34°42' E = 180- 34°42' = 145°

(b) WCB of N 02°18' W = 360- 02°18' = 357°4

17. Differentiate between the fore bearing and back bearing of a line. The fore bearing of a line PQ is N 28□ W. What is its back bearing? (Nov/Dec 2005)

The bearing of a survey line in the direction of the progress of survey is known as Fore Bearing (or) Forward Bearing (FB), and the bearing taken in the opposite direction of the progress of survey is called Reverse (or) Back Bearing (BB).

If the fore bearing of the given line PQ is N 28° W, its back bearing is S 28° E

18. Name some of the accessories used in plane tabling. (May / June 2007)(Nov/Dec 2007)
The following instruments are used in plane tabling.

1. Plane table with tripod stand
2. Alidade (or) Sight Rule
3. SpritLevel
4. Compass
5. Plumbing Fork
6. Drawing Paper

19. Name some of the errors in plane table surveying. (May / June 2006)

Various errors in plane table surveying are classified as follows.

1. Instrumental Errors.
2. Plotting Errors.
3. Manipulation and Sighting errors.

20. What is resection in plan tabling? (May / June 2012)

Resection is defined as the process of locating the plane table station, by back ray method from the plotted station on the sheet. This method is also called Interpolation method (or) Fixing method.

1. Back ray method

2. Two point Problem method

3. Three point Problem method

4. A box compass method.

21. What is Two-Point Problem? (May / June 2013)

Two-Point problem is defined as the process of locating the plane-table station on the sheet, by sighting two well-defined points and its locations are already plotted on the paper.

22. Define Three-Point Problem? (Nov/Dec 2005) (May / June 2009)

Three point problems is defined as the process of locating the plane table station on the sheet by sighting three well defined points and its locations are already plotted on the paper.

23. *When is plane table surveying opted? (Nov/Dec 2006)*

✓ Plane table surveying suitable,

- When the time required to survey the area in the field is comparatively high
- Where higher accuracy is not required.
- For small scale maps
- For magnetic areas, where a compass survey is not reliable.

25. What is the use of trough compass in plane table surveying? (Nov/Dec 2012)

A trough compass in plane table surveying is used for orienting the plane table to the magnetic north.
The edge of the compass box is perfectly straight and the bottom is perfectly flat. A line along the edge of the compass is drawn, which defines the magnetic north.