Figure 20.4 Sectional view of a Thedolite

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EXPERIMENT NO: 1   **DATE:**

STUDY OF THEODOLITE

AIM

To study about the Temporary and Permanent adjustments of a Theodolite

ADJUSTMENTS OF THEODOLITE

The Theodolite should be properly adjusted to obtain accurate observations. The adjustments are mainly of two types. They are as follows:

1. **Permanent adjustments and**
2. **Temporary adjustments**

1. **Permanent adjustments**

The permanent adjustments are to be done to maintain the required standard relationship between the fundamental lines (axes) of a Theodolite. The fundamental lines are as follows

a. Vertical axis
b. Horizontal axis or trunnion axis
c. Line of collimation or line of sight
d. Axis of plate level
e. Axis of altitude level

Required relations between the fundamental lines (axes)

➢ The axis of plate level must be perpendicular to the vertical axis.
➢ The line of collimation must be perpendicular to the horizontal axis
➢ The horizontal axis must be perpendicular to the vertical axis.
➢ The axis of the altitude level must be parallel to the line of collimation.
➢ The vernier reading of vertical circle must read zero when the line of
   Collimation is horizontal.

The permanent adjustments of a Theodolite are:

➢ Adjustment of plate level
➢ Adjustment of line of sight
➢ Adjustment of horizontal axis
➢ Adjustment of altitude bubble and vertical index frame

Temporary adjustments
The adjustments which are carried out at every setting of the instrument before the observations are referred as temporary adjustments. There are three types of temporary adjustments as follows.

➢ Setting up
➢ Levelling up
➢ Elimination of parallax

a) Setting up

This adjustment includes the following two operations

➢ Centering the Theodolite over the instrument station
➢ Approximate leveling of Theodolite with the help of the tripod legs only
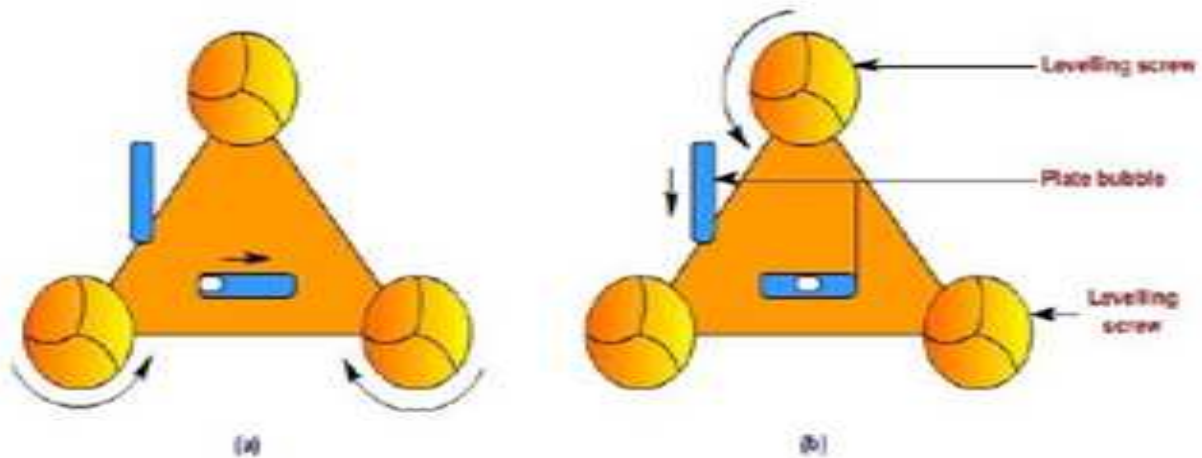
Centering

It is the operation by which the vertical axis of the theodolite represented by a plumb line is made to pass through the mark of instrument station on the ground.

Approximate leveling

The approximate leveling may be done with the reference to a small circular bubble provided on the tribrach or by eye judgements

b) Levelling up

The operation of making the vertical axis truly vertical is known as leveling of the Theodolite. After the centering and approximate leveling an accurate leveling is to be done with the help of foot screws

i)   First the telescope is to be kept parallel to any of the two foot screws as in the figure
ii)   The bubble of plate level is to be brought to the centre of its run by turning the foot screws either inwards or outwards simultaneously
iii)   Then the telescope is to be turned through 90°, so that it lies over the third foot screw (i.e perpendicular to the first position)
iv)   The bubble is to be brought to the centre of its run by turning the third foot screw either clockwise or anticlockwise
v)   If the bubble is not in centre the above operations are repeated till the bubble retain at centre in both the positions

c) Elimination of parallax
An apparent change in the position of an object caused by the change in position of the observer's eye is known as parallax. This can be eliminated in two steps.

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1) Focusing the eye piece for distinct vision of the cross hairs
2) Focusing the objective to bring the image of the object in the plane of cross hairs.

1) Focusing the eye piece

➢ The telescope is to be pointed towards the sky or a sheet of white paper is to be hold in front of the objective.
➢ The eye piece is to be moved in or out by rotating it gradually until the appearance of cross hairs becomes sharp and distinct.

2) Focusing the objective

➢ Telescope is to be directed towards the object.
➢ Focusing screw is to be turned until the appearance of the object becomes sharp and clear.

RESULT:

Thus the study about the Temporary and Permanent adjustments of a Theodolite is practiced.

EXPERIMENT NO: 2(A)   **DATE:**

MEASUREMENT OF HORIZONTAL ANGLES

AIM

      To measure the horizontal angle by Repetition method with the use of Theodolite

APPARATUS USED

1. Theodolite,
2. Ranging rods,
3. **Pegs or Arrows**

PROCEDURE

1. Theodolite is set over an instrument station (O) exactly and all the temporary adjustments are done. Vertical circle is placed left to the observer (face left observation).
2. Vernier A is set to Zero with the help of upper clamp screw and tangent screws Readings of Vernier A and B are noted
3. Upper clamp is clamped. Lower clamp is loosened and the telescope is turned towards "P". Lower clamp is clamped and the point "P" is bisected exactly using tangent screws
4. Both the vernier A and B are read and noted (Must be equal to 0° and 180° respectively).Upper clamp is unclamped and the telescope is turned clockwise and "Q" is bisected.
5. Upper clamp is clamped and "Q" is bisected exactly using tangent screws. Both the verniers are read. Mean of the readings provide an approximate included angle of POQ.
6. The reading of vernier A gives directly the angle POQ, and 180° is subtracted by the reading of vernier B. The mean value of two readings gives the angle POQ with one face
7. Lower clamp is unclamped and the telescope is turned anticlockwise to sight P again. Lower clamp is clamped and P is bisected exactly using tangent screws
8. Upper clamp is loosened and the telescope is turned clockwise and Q is bisected. Upper clamp is clamped and Q is bisected exactly using tangent screws. The vernier now read twice the value of angle POQ.
9. Last two steps (7&8) are repeated once again to get the thrice value of angle POQ
10. Finally obtained reading is divided by 3 to get the mean value of angle POQ.
11. The face is changed and the whole process is repeated. (Face right observations).
12. Average value of two horizontal angles obtained with face left and face right observations is determined.

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Face:-		Swing:-				Face:-		Swing:-		
Instument station	Sight to	A	B	MEAN	AVERAGE HORIZONTAL ANGLE	A	B	MEAN	AVERAGE HORIZONTAL ANGLE	
		° ' "	° ' "	° ' "	° ' "	° ' "	° ' "	° ' "	° ' "	
o	P									

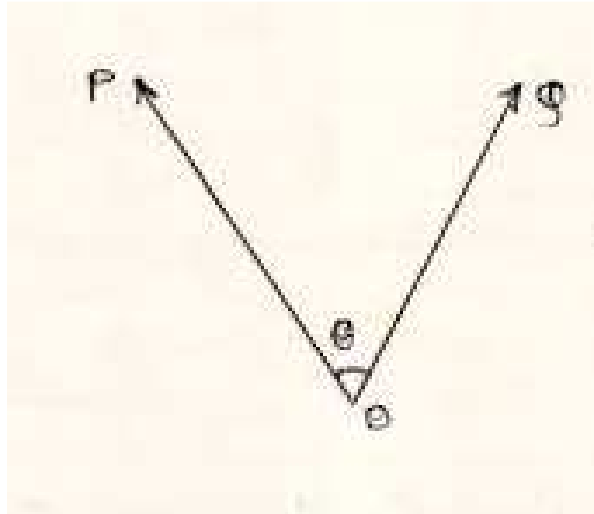**Calculation:**

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RESULT:

        The horizontal angle measured at O between P and Q. i.e ∠POQ

    a) With face left   -
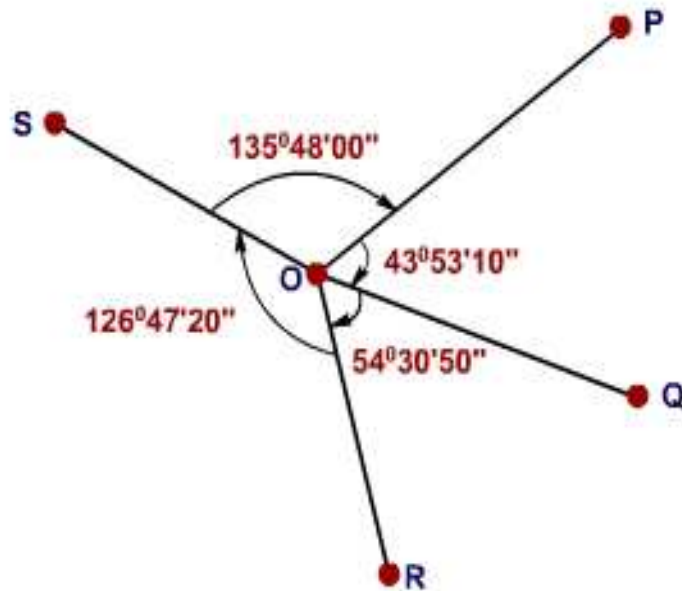   b) With face right -
    c)   Average   -

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Figure 22.2 Measurement of Horizontal Angle by
method of Reiteration

EXPERIMENT NO: 2(B)   **DATE:**

MEASUREMENT OF HORIZONTAL ANGLES
BY REITERATION METHOD

AIM

To measure the horizontal angle by Reiteration method with the use of Theodolite

APPARATUS USED

1. Theodolite
2. Ranging rods
3. Pegs or Arrows

THEORY:-

Reiteration is a method of measuring horizontal angles with high precision. It is less
Tedious and is generally preferred when there are several angles to be measured at a station.
Several angles are measured successively and finally the horizon is closed. Closing the
orizon is the process of measuring the angles around a point to obtain a check on their sum
Which should be equal to 360°.

PROCEDURE:-

1. Select a station point O.

2. Set the theodolite at O and do the temporary adjustments. The telescope is adjusted for right face right swing.

3. Set the vernier A to zero using upper clamp. Loosen the lower clamp, direct the telescope to the

Face:-	Swing:-	Face:-	Swing:-

station point A and bisect A exactly by using the lower clamp and lower tangent screw.

4. Note the vernier readings (A and B).

5. Loosen the upper clamp and turn the telescope clockwise until the point B is exactly bisected.

6. Note the vernier readings (A and B).

7. The mean of the two vernier readings gives the value of <AOB.

8. Bisect all the points successively and note the readings of both verniers at each bisection.

9. Finally close the horizon by sighting the station point A. The A vernier should be 360^0. If not, note the closing error.

10. Adjust the telescope for left face left swing.

11. Repeat the whole process by turning the telescope in anticlockwise direction.

12. Distribute the closing error proportionately the several observed angles.

13. Take the average of face left and face right observations to give the corresponding horizontal angles.

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Instument station	Sight to	A			B			MEAN			AVERAGE HORIZONTAL ANGLE			A			B			MEAN			AVERAGE HORIZONTAL ANGLE		
		°	′	″	°	′	″	°	′	″	°	′	″	°	′	″	°	′	″	°	′	″	°	′	″
o	P																								

CALCULATION:

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RESULT:

The horizontal angle measured at O between P and Q. i.e ∠POQ

a) With face left:-
b) With face right:-
c) Average:-

EXPERIMENT NO: 3   **DATE:**

TRIGONOMETRIC LEVELING –HEIGHTS AND DISTANCES PROBLEM (TWO EXERCISES)
(A) BASE ACCESSIBLE

Aim:

To find the elevation of the top of a spire / tower / building using the principle of trigonometric leveling.

Equipment:

Transit Vernier Theodolite, Tripod stand, Plumb bob, Tape, Leveling Staff and Pegs.

Procedure:

It is required to find the elevation (R.L.) of the top of a tower 'Q' from the instrument station 'P' as shown in Fig.7.

Fig.7 Base Accessible

Let,

P= instrument station
Q= Point to be
observed
A= center of the instrument
D= horizontal distance between P
and Q h' = height of the instrument
at P Q'=Projection of Q on
horizontal plane
S= Reading on staff kept on B.M, with line of sight on horizontal
α= Angle of elevation from A to Q

1. Setup the Theodolite at P and level if accurately w.r.t. the altitude bubble. See that the vertical circle reads $0^0 0' 0''$ when the line of sight is horizontal.

2. Direct the telescope towards Q and bisect it accurately clamp both the plates. Read the vertical angle 'α'.

3. Plunge the telescope and sight to the same point 'Q' and take the vertical angle 'α' calculate the avg. of the vertical angles measured in both faces.

take   the reading on the leveling staff kept at A.B.M. Let it be 'S'.

Observations and Calculations:

Vertical Angle, α =   Staff Reading, S (m) =   Horizontal Distance, D (m) =

From Triangle AQQ': h = D tanα

R.L. of Q (m) = R.L of B.M + S + h where h =
                D tanα (Or)

R.L. of Q (m) = R.L of instrument axis +
                D tanα (Or)

R.L. of Q (m) = R.L of P + h' + D tanα, if R.L of P is Known

Result:

R.L. of Q (m) = R.L of B.M + S + h where h = D tanα

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(B) BASE INACCESSIBLE (SINGLE PLANE METHOD)

Aim:

To find the elevation of the top of a building using the principle of trigonometrically leveling with the instrument stations having their vertical axes in the same plane as the object.

Equipment:

Transit Vernier Theodolite, Tripod Stand, Plumb Bob, Tape, Leveling Staff and Pegs.

Procedure:

It is required to find the elevation (R.L.) of the top of a building 'Q' from the instrument stations P & R as shown in Fig.8.

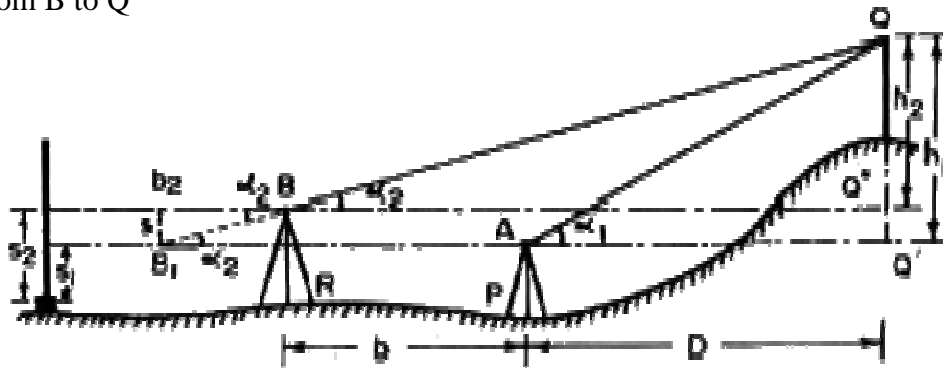**Fig.8 (a) Instrument Axis at Same Levels**

h = QQ'

b = Horizontal dist.
b/w P & R D =
Horizontal dist. b/w
P& Q

α1 = angle of elevation
from A to Q
α2 = angle of elevation
from B to Q

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Fig.8 (b) Instrument Axes at Different Levels

1.   Setup the Theodolite at P and level it accurately with respect to the altitude bubble. See that the vertical circle reads $0^0$0'0" when the line of sight is horizontal.

2.   Direct the telescope towards Q and bisect it accurately clamp both the plates. Read the vertical angle α1.

3.   Transit the telescope so that the line of sight is reversed. Mark the instrument station R on the ground along the line of sight. Measure the dist. b/w P&R accurately. Let it be 'b' repeat the steps (2) & (3) for both face observations. The mean values should be adopted in the calculations.

4.   With the vertical vernier set to zero reading and the altitude bubble in the center of its run take the reading on the leveling staff kept at A.B.M. Let it be 'S' if both the instrument axis are at same level and 'S1' if they are at different levels.

5.   Shift the instrument to R and set up the Theodolite there. Measure the vertical angle 'α2 ' to Q with both face observations.

6.   In case of instrument axis at different levels repeat the step (4) and let the reading at R be 'S2'.

Observations and Calculations:

Vertical Angles, α1 =   Staff Readings S1 (m) =   (or) S (m) =
                  α2 =   S2 (m) =

Horizontal dist. b/w P & R = b =

In case of instrument axis at same level:
From triangle AQQ' h = D tanα1
From
triangle QQ'
h = (b + D)
tanα2

D =   b tan<u>α2.</u>
    tanα1 - tanα2

R.L. of Q (m) = R.L. of B.M. + S + h
In case of instrument axis at different levels:
H1-h2 = S2~S1 = S

D =   S + b tan<u>α2.</u>
    tanα1 - tanα2
h1 = D tanα1

h2 = (b + D) tanα2

R.L. of Q = R.L. of B.M. + S1 + h1

R.L. of Q = RL of B.M. + S2 + h2

Result:

R.L. of given point Q (m) =

EXPERIMENT NO: 4   **DATE:**

HEIGHTS AND DISTANCE USING PRINCIPLES OF TACHEOMETRIC SURVEYING (TWO EXERCISES)

Aim:

To determine the Tacheometric constants using Tacheometer.
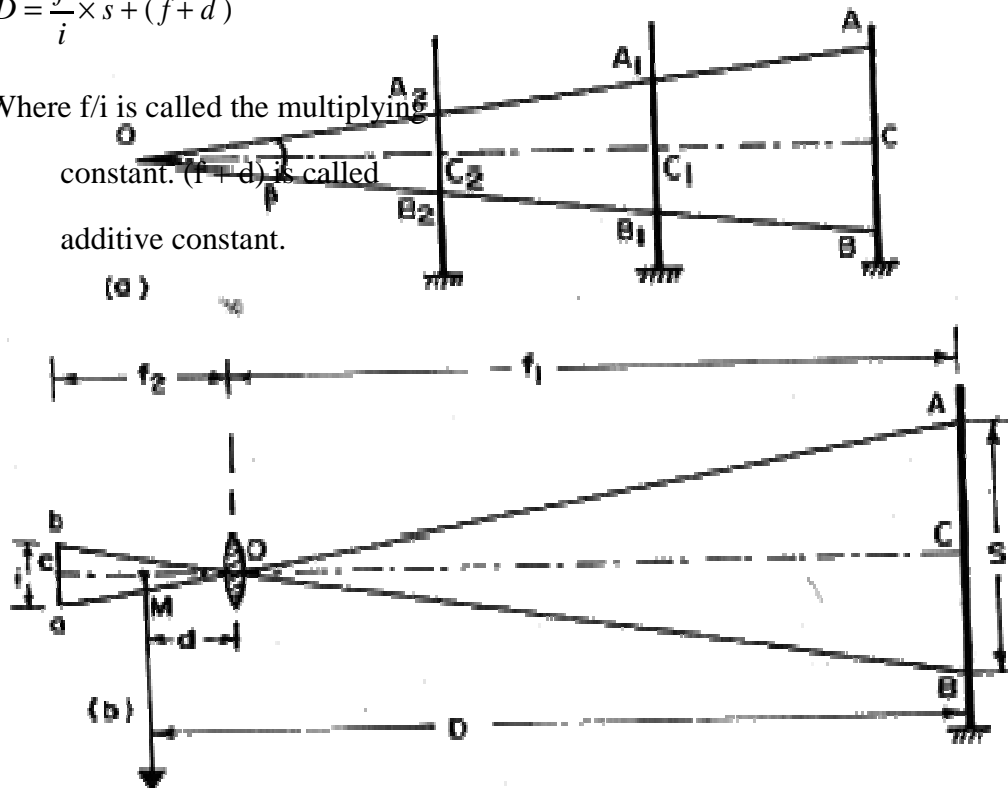
Equipment:

Tacheometer, Chain (or) Tape, Pegs and Levelling Staff.

Principle:

Distance between two points is given by (Fig.16)

$$D = \frac{f}{i} \times s + (f + d)$$

Where f/i is called the multiplying constant. (f + d) is called additive constant.

Fig.16 Tachometric Constants

Procedure:

1. Setup the instrument at one end of a straight line say 50m

2. Drive pegs at 10m, 20m, and 25m and at 50m lengths...

3. Keep the staff on the pegs and observe the corresponding staff intercepts with horizontal sight.

4. Knowing the values of 'S' and corresponding 'D' values for different peg intervals a number of similar equations can be formed by substituting the values of 'S' and 'D' in equation

   a. $D = KS + C$

5. The simultaneous equations are taken two at a time to find the values of 'K' and 'C'.

6. The average values of 'K' and 'C' are found.

Observations and Calculations:

Horizontal Distance, D (m) =

Staff Intercept, S (m) =

$D = KS + C$

Result:

For the given instrument

f/i = multiplying constant (K)   =

f+d = Additive constant (C)   =

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EXPERIMENT NO: 5   **DATE:**

CURVE SETTING- DIFFERENT METHODS.
(TWO EXERCISES)

(A) SETTING OUT A SIMPLE CURVE BY MEANS OF OFFSETS FROM LONG CHORD

Aim:

To setout the simple curve of given radius and length of long chord by means of offsets from the long chord.

Equipment:

Theodolite, Tripod Stand, Cross-Staff, Ranging Rods, Pegs, Chain and Tape.

Principle:

Setting out a curve by method of offsets from long chord is linear method. It involves setting out the normal offsets of the long chord at specified intervals and joining them.

The length of offsets at any distance 'x' from the mid points of the long chord is given by

Where Ox = length of offset at a distance 'x' from the mid of long chord.

         X= specified distance between offsets.
         L= length of the long chord.

         R= Radius of the curve

$$O_o = R - \sqrt{R^2 - \left(\frac{L}{2}\right)^2} \text{(Mid Ordinate)}$$

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Usually, the offsets from the mid of long chord towards the end are setout and the curve is symmetric over the central offset line.

Procedure:

1. The obtained length of long chord is first setout on the field by proper ranging and mid point is established (Fig.10)

2. The length of offsets at mid length is to be setout. For this, a person holds the cross-staff at required point and aligns the slit with the end station ranging rods. At this instant another person looks through the normal slit and guides a person with a ranging rod to come into its view thus along this line normal to long chord, the calculated offset is setout.

3. The cross staff is shifted to next point distance 'x' as specified and above step is repeated the offset corresponding to that distance is set out from that point.

4. Pegs are marked at the end of the offsets, the joining of which completes the setting.

Observations and Calculations:
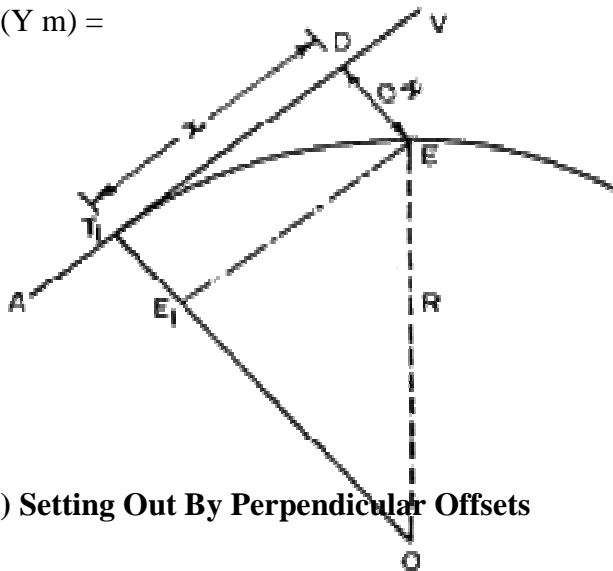
5. Distance (X m) =
   Ordinate (Y m) =

Fig.10 (b) Setting Out By Perpendicular Offsets

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Result: The simple curve is setout by the method of offsets from long chord in the field.

Applications: Curves are used on highways and railways where it is necessary to change the direction of motion.

(B) SETTING OUT A SIMPLE CURVE BY RANKINE'S METHOD

Aim:

Two tangents intersect at a given chainage & with the given deflection angle. Calculate all the data necessary for setting out a curve with a given radius by Rankine's method or Deflection Angle Method or One Theodolite Method. The peg interval is 30m.

Equipment:

Transit Theodolite, Tripod Stand, Tape & Chain, Ranging Rods, and Pegs.
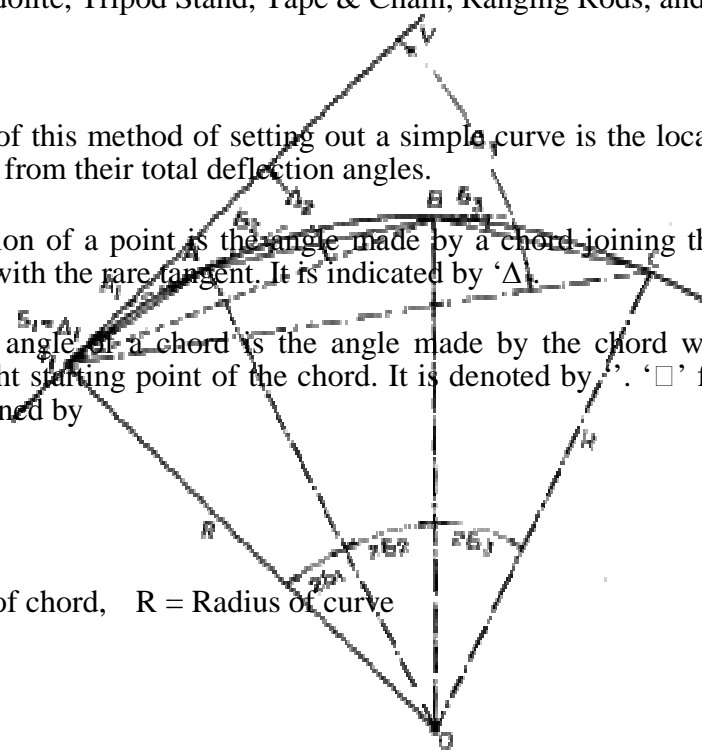
Principle:

A substance of this method of setting out a simple curve is the location of various points on the curve from their total deflection angles.

Total deflection of a point is the angle made by a chord joining that point to the point of curvature with the rare tangent. It is indicated by 'Δ'.

A deflection angle of a chord is the angle made by the chord with the tangent drawn at the straight starting point of the chord. It is denoted by /'. '□' for given chord lengths are determined by

$$\delta = \frac{1718.9\ C}{R}$$

Where C= Length of chord,   R = Radius of curve

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Procedure:

1. Locate points T1, T2 and V (Fig.11).

2. Setup the Theodolite exactly at point T1 and make its temporary adjustments.

3. Set the 'A' – vernier to zero degrees and bisect the point V, clamp the lower plate.

4. Release the upper plate and set the 'A'-vernier to read Δ1 the line of sight is thus directed along T1 A.

5. Hold the zero of the tape at T1 & take a distance C1 (T1A) and swing the tape with an arrow till it is bisected by the Theodolite. This establishes the first point A on the curve.

6. Set the second deflection angle Δ2 on the vernier so that the line of sight is set along T1B.

7. Hold the zero of the tape at point A and an arrow at the other end (AB), swing the tape about point A till the arrow is bisected at point B. This establishes the second point B on the curve.

8. The same steps are repeated till the last point T2 is reached.

Observations and Calculations:

$$\delta = \frac{1718.9}{R}$$

C = deflection angle, δ_1, δ_2, δ_3 … etc., are the successive deflection angles

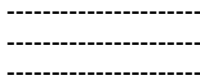Where C = Length of chord, C_1, C_2,…etc., are the successive chord lengths R = Radius of curve

Let ABCD ….. be the points on the curve the total deflection angles of which are Δ_1 Δ_2 Δ_3 …

then

Δ1 = δ1

Δ2 = Δ1 + δ2

And   Δn = Δn-1 + δn

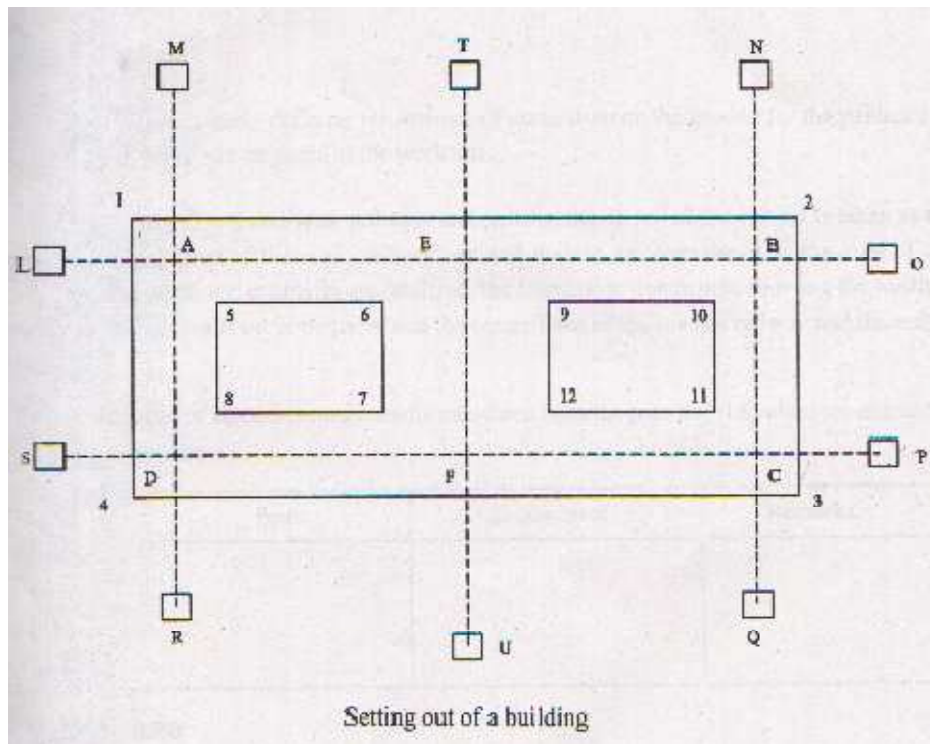Length of Long Chord L = 2R SIN Δ/2

Tangent length (T1V) = R Tan Δ/2

Length of Curve = R Δ (Δ/180)

Chainage of point T1 = Chainage of V – T1V

Chainage of point T2 = Chainage of T1 + Length of Curve

Result:

The required simple circular curve is set out in the field by Rankine's Method.

Setting out of a building

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EXPERIMENT NO: 6   **DATE:**

SETTING OUT WORKS FOR

BUILDINGS AND PIPE LINES

AIM
To set out the foundation marking for the proposed construction of building.

APPARATUS USED
1. Theodolite
2. Ranging rods
3. Pegs or Arrows
4. String.

THEORY:-
Setting out of a building involves the transfer of the architect's plan from paper onto the actual site. The object of setting out a building is to provide the builder with clearly defined outlines for excavations. Two methods are generally used for setting out a building.

PROCEDURE:-
1. A centre line sketch of the building is prepared. (The centres of cross walls are also to

be indicated.)

2. The base line is set out with reference to given reference points.

3. The ends of the centre line of the walls, points A and B from the base line are marked.

4. As the end marks A,B,C,etc. are disturbed during excavation, stakes are fixed at L,M,N etc., a little away (about 2 to 3 m) for end mark and tied accurately using a string.

5. The centre line for all other walls AD,BC,etc are marked by dropping perpendicular. For small buildings the perpendiculars may be set out by using a chain or a tape by '3-4-5' method. For an important and big building when sides are long a Theodolite may be employed to accurately set out the perpendiculars and to range the lines.

6. For every wall, the pegs are driven a little away for marking the end and tied accurately using a string.

7. Diagonals are measured and checked with their corresponding calculated lengths.

8. Width of foundation from the centerline are marked and the corners 1,2,3,4,5 etc., are fix up. Pegs are driven at these corners. The cord is stretched and lime is spread along the chords.

RESULT:

Thus the trench plan being marked on the ground, and excavation may be started.

EXPERIMENT NO: 7   **DATE:**

DETERMINE OF AREA USING TOTAL STATION

AIM:

To determine the given plot's surface area.

APPARATUS:
1. Total station
2. Prism with other accessories.

THEORY:
The computations of areas and volumes is often required in civil engineering practice. One of primary aims of land surveying is to determine the are of land under survey. Which is usually the property of an individual or institution. In plane surveying the team "area" refers to the orthogonal projection of ground on a horizontal plane, not actual the ground surface.

PROCEDURE:

(a) Make a quick 'eye ball' plan view sketch of the map area in the field book. This will b e an important reference to which you will later append information such as the location of home stations, back sights etc.

(b) Take a few minutes to walk around your map area figure out where the optional places for home stations, back sights and transverses are.

(c) Select a suitable location and setup instrument and do all necessary station adjustments and job selection.

(d) Allocate the [Area] soft key to [meas] mode screen.

(e) Press [Area] to begin surface area calculation.

(i) Sight the first point on the line enclosing the area and press [meas].

(ii) Press [OBs] to begin observation. The measured values are displayed. The [OBs] function requires each point to be observed individually before area calculation is performed.

(iii) When [Read] is pressed registered co-ordinates can be recalled and used in subsequent measurement.

(iv) Press [ok] to enter the values of point.

(f) Repeat 'd' until all the points have been measured. Points on the enclosed area are observed in a clock wise or counter clock wise direction.

(g) After all the points necessary to calculate the surface area have observed press [calc] to display calculated area.
(h) Press (ok) to quit area calculation and return to [MEAS] mode.
RESULT:
> The area of given points is _____ m^2.

EXPERIMENT NO: 8   DATE:

TRAVERSING USING TOTAL STATION

Aim:

> To do a closed traversing for at least five points using Total Station.

Equipment:

1.   Total Station
2.   Tripod
3.   Prism and Pole
4.   Arrows

5. Field Book

Procedure:

1. Identify the points on the ground for traversing and mark them arrows.

2. Choose a control point for using it as first station point such that at least one control point for back-sight is visible

3. Set up the instrument on the point chosen in step 2.

4. **Press** MENU

5. **Press** F1 (Programs)

6. **Press** F1 (Survey).

7. **For Setting up the job as you know the coordinates of two control points on the paper follow the following steps.**

8. **Press** F1 (Set Job).

9. **Press** F1 (New)**.**

10. **Enter the New Job Name by pressing** F1 (Input).

11. **Give the name of the job by using the Function key** F1 to F4.

12. **Press** F4 (OK).

13. **Press** F2 (Set Station)**.**

14. **In front of the station give the number of the station by giving the number of the station where you are standing.**

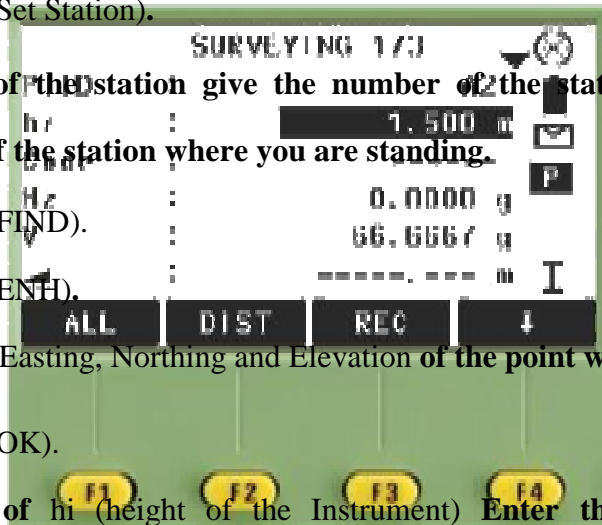15. **Press** F2 (FIND).

16. **Press** F4 (ENH).

17. **Enter the** Easting, Northing and Elevation **of the point where you are standing.**

18. **Press** F4 (OK).

19. **In front of** hi (height of the Instrument) **Enter the Instrument height by measuring it.**

20. **Press** F3 (Set Orientation).

21. **Press** F2 (Coordinates).

22. **In front of BS (Back Sight) Enter the number of the back sight point to which you are aligning.**

23. **Press** F4 (ENH)**.**

24. **Press** F4 (OK).

25. **Press** PAGE.

26. **Press** F4 **until you have** DIST **In front of** F1**.**

27. **The value in front of gives the relative error in the station shifting.**

28. **Press** F2 (REC).

29. **Press** F4 (NO).

   Press F4 (Start)

31. Take foresight on first traverse point enter point ID and record its coordinates. (This point will be the next instrument station)

32. Shift the instrument to first traverse point and follow the standard procedure to obtain the coordinates of second traverse point.

33. Continue until you finish all traverse points.

34. Check whether there is any closing error. If it is there apply corrections to the coordinate and plot the traverse.

(If you are using advanced instruments closing error will be shown automatically in traverse report and traverse can be adjusted on board)

Result:

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Record the coordinates obtained for each point in your field book. If there is a closing error apply correction to all the coordinates. Plot the survey on a drawing sheet using the corrected coordinates.

Applications:

In control surveys and topographical surveys it is required to do traversing. In control surveys, using the existing control points it is required to establish new control points. In topographical surveys using the existing control points and also by establishing new control points it is required obtain the coordinates of various details like buildings, roads and other features

EXPERIMENT NO: 9   **DATE:**

CONTOURING USING TOTAL STATION

Aim:

To prepare Contour map of an area using Total Station

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Equipment:

1. Total Station
2. Tripod
3. Prism and Pole
4. Arrows
5. Field Book

Procedure:

1. Obtain the coordinates of all the grid points and record them in your field book

2. Choose a control point from where all the grid points and at least one control point for back-sight are visible.

3. Set up the instrument on the point chosen in step 2.

4. **Press** MENU

5. **Press** F1 (Programs)

6. **Press** F2 (Stake Out).

7. **For Setting up the job as you know the coordinates of two control points on the paper follow the following steps.**

8. **Press** F1 (Set Job).

9. **Press** F1 (New)**.**

10. **Enter the New Job Name by pressing** F1 (Input).

11. **Give the name of the job by using the Function key** F1 to F4.

12. **Press** F4 (OK).

13. **Press** F2 (Set Station)**.**

14. **In front of the station give the number of the station by giving the number of the station where you are standing.**

15. **Press** F2 (FIND).

16. **Press** F4 (ENH)**.**

17. **Enter the** Easting, Northing and Elevation **of the point where you are standing.**

18. **Press** F4 (OK).

19. **In front of** hi (height of the Instrument) **Enter the Instrument height by measuring it.**

20. **Press** F3 (Set Orientation).

21. **Press** F2 (Coordinates).

22. **In front of BS (Back Sight) Enter the number of the back sight point to which you are aligning.**

23. **Press** F4 (ENH).

24. **Press** F4 (OK).

25. **Press** PAGE.

26. **Press** F4 **until you have** DIST **In front of** F1.

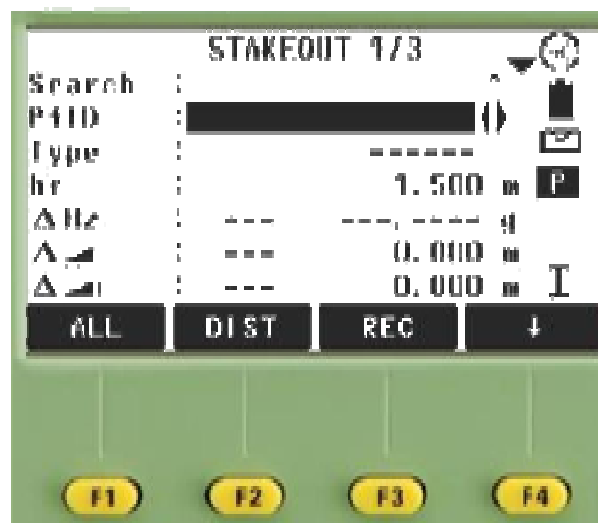27. **The value in front of gives the relative error in the station shifting.**

28. **Press** F2 (REC).

29. **Press** F4 (NO).

30. **Press** F4 (Start).

31. **Press** F4 **until you have** MANUAL **in front of** F3**.**

32. **Enter** East, North **and** Height **for the point to be staked.**

33. **Now Move the Instrument until** Hz **equal to zero.**

34. **Now move the prism in this line of sight to the distance given in front of** △ ◢ : --- 0.000 m **from the instrument station.**

35. **Now with moving the instrument horizontally with moving the telescope up and down only tells the prism man to come in line of sight of that point. Again Press** F2 (DIST) **do this until the value comes near to the limiting factor and you have the point. Then press** All **or** trigger button **to record the point.**

Result:

Record the coordinates of all the points surveyed in your field book and using this data create a contour map of the area surveyed.

Applications:

In topographical surveys, it is required to obtain contour maps/ plans of an area. Contour maps are useful in planning and construction of pipeline works, road works and residential colonies etc.

EXPERIMENT NO: 10   **DATE:**

DETERMINATION OF REMOTE HEIGHT USING TOTAL STATION

AIM:

    To determine remote height of object whose top is in accessible

APPARATUS:
1. Total station
2. Prism with other accessories.
3.

THEORY:

A Rem measurement is a function used to measure the elevation of a point where a target cannot be directly installed power line, over had cables and bridges etc.

PROCEDURE:

1. Select a suitable location and set up instrument and do all necessary adjustment and job selection.

2. Allocate the Rem soft key to the Meas mode screen.

3. Select the target directly or directly over the object and measure target height with total station.

4. After inputting the height measured accurately sight the target. Press Dist in page of meas mode to carry out measurement. The measured distance data, vertical angle and horizontal angle displayed. Press stop to stop measurement.

5. Sight object and then press Rem. The REM measurement is started and height from the ground to object is displayed in 'Ht'.

6. Press stop to terminate the measurement operation.

7. To Re observe the object, sight the target, then press OBS.

8. Press (ESC) to finish and return to the MEAS mode screen.

RESULT:

The elevation of given water tank = 1.45 + 20.045 m
= 21.49m.

EXPERIMENT NO: 11   **DATE:**

STAKE OUT USING TOTAL STATION

Aim:

To set out column centres of a proposed building.

Equipment:

1. Total Station

2. Tripod

3. Prism and Pole

4. Arrows
5. Field Book

Procedure:

1. Obtain the coordinates of all the column centers.

2. Choose a control point from where all column positions and at least one control point for back-sight are visible.

3. Set up the instrument on the point chosen in step 2.

4. **Press** MENU

5. **Press** F1 (Programs)

6. **Press** F2 (Stake Out).

7. **For Setting up the job as you know the coordinates of two control points on the paper follow the following steps.**

8. **Press** F1 (Set Job).

9. **Press** F1 (New)**.**

10. **Enter the New Job Name by pressing** F1 (Input).

11. **Give the name of the job by using the Function key** F1 to F4.

12. **Press** F4 (OK).

13. **Press** F2 (Set Station)**.**

14. **In front of the station give the number of the station by giving the number of the station where you are standing.**

15. **Press** F2 (FIND).

16. **Press** F4 (ENH)**.**

17. **Enter the** Easting, Northing and Elevation **of the point where you are standing.**

18. **Press** F4 (OK).

19. **In front of** hi (height of the Instrument) **Enter the Instrument height by measuring it.**
20. **Press** F3 (Set Orientation).

21. **Press** F2 (Coordinates).

22. **In front of** BS (Back Sight) **Enter the number of the back sight point to which you are aligning.**

23. **Press** F4 (ENH).

24. **Press** F4 (OK).

25. **Press** PAGE.

26. **Press** F4 **until you have DIST In front of F1.**

27. **The value in front of gives the relative error in the station shifting.**

28. **Press** F2 (REC).

29. **Press** F4 (NO).

30. **Press** F4 (Start).

31. **Press** F4 **until you have MANUAL in front of F3.**

Enter East, North **and** Height **for the point to be staked.**
33. **Now Move the Instrument until** Hz **equal to zero.**

34. **Now move the prism in this line of sight to the distance given in front of**
    Δ ⊿   :   ---   0.000 m **from the instrument station.**

35. **Now with moving the instrument horizontally with moving the telescope up and down only tell the prism man to come in line of sight of that point. Again Press F2 (DIST) do this until the value comes near to the limiting factor and you have the**

point.

36. **For the next point again Press** F4 **until you have manual in front of F3 and again enter the coordinates of the next point to be staked repeat this process for all the points.**

<u>**Result**</u>: **:**

Record the details of points set out in your field book.

<u>**Applications:**</u>

In setting out a building, a surveyor has to set out position of columns and other elements of the building in both horizontal and vertical planes.

EXPERIMENT NO 12   **DATE**

DISTANCE, GRADIENT AND DIFFERENCE OF HEIGHT BETWEEN TWO INACCESSIBLE POINTS USING TOTAL STATION

Aim:

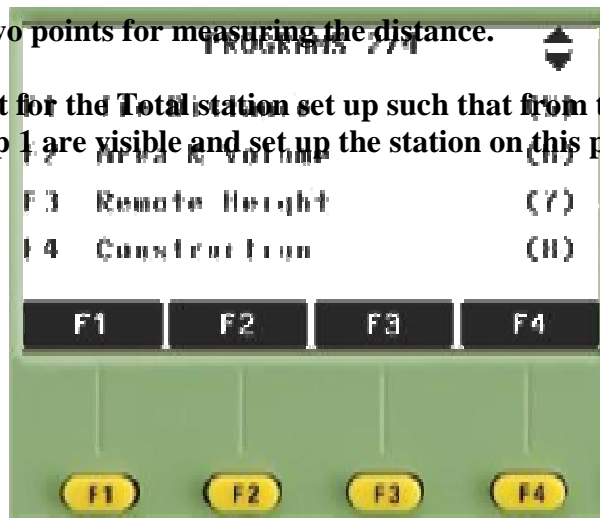To obtain the distance, gradient and difference of height between two in accessible points using the Total Station.

Equipment:

1. Total Station

2. Tripod

3. Prism and Pole

4. Field Book

Procedure:

The Tie Distance Program is used to find the horizontal distance between two points by measurement in the field.

1. **Identify the two points for measuring the distance.**

2. **Choose a point for the Total station set up such that from this point the two points marked in step 1 are visible and set up the station on this point.**

3. **Press** MENU.

4. **Press** PAGE.

5. **Press** F1 (Tie Distance).

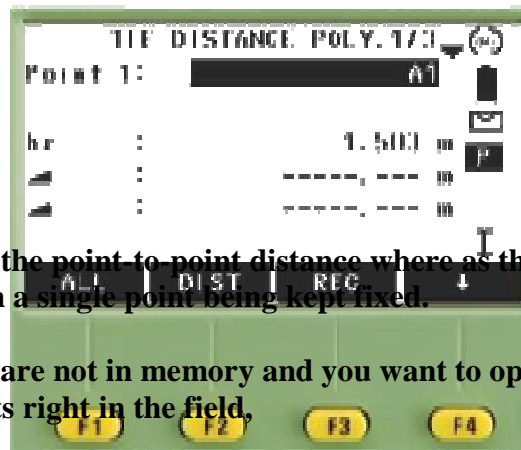6. The First three steps (F1, F2 and F4) are for station setup and orientation (refer to Step1 and **Step 2).**

7. **Press F4 (Start).**
8. **There are two type of distance Polygonal and Radial.**

9. **The Polygonal is the point-to-point distance where as the Radial is used for finding the distance from a single point being kept fixed.**

10. **When the Points are not in memory and you want to operate the program by taking the measurements right in the field,**

11. **In front of the point enter the number of the point and Press** F3 (ALL).

12. **In front of the point2 Enter the number of the second point again sight it and press**

F3 (ALL).

13. **Now you can see the results displayed on the screen.**

Result:

The distance (d), gradient (s) and difference of height (h) between two in accessible points
are, d =   , s =   , h =

Applications:

In topographical surveys, some times features like buildings etc. are not accessible. Therefore a
surveyor should be familiar with the technique of obtaining the horizontal distance, difference in
height and hence the gradient between two inaccessible points.