

# **ADVANCED SURVEYING**

## **LAB MANUAL**

**Academic Year** : 2017 - 2018  
**Course Code** : ACE 106  
**Regulations** : IARE – R16  
**Class** : IV Semester  
**Branch** : CIVIL ENGINEERING



**Department of Civil Engineering**

**INSTITUTE OF AERONAUTICAL ENGINEERING**

**(Autonomous)**  
**Dundigal, Hyderabad – 500 043**



# **INSTITUTE OF AERONAUTICAL ENGINEERING**

**(Autonomous)**  
**Dundigal, Hyderabad - 500 043**

## **DEPARTMENT OF CIVIL ENGINEERING**

**Program: Bachelor of Technology (B. Tech)**

### **VISION OF THE DEPARTMENT**

To produce eminent, competitive and dedicated civil engineers by imparting latest technical skills and ethical values to empower the students to play a key role in the planning and execution of infrastructural & developmental activities of the nation.

### **MISSION OF THE DEPARTMENT**

To provide exceptional education in civil engineering through quality teaching, state-of-the-art facilities and dynamic guidance to produce civil engineering graduates, who are professionally excellent to face complex technical challenges with creativity, leadership, ethics and social consciousness.



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

## DEPARTMENT OF CIVIL ENGINEERING

### Program: Bachelor of Technology (B. Tech)

PROGRAM OUTCOMES (PO's)	
PO 1	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	<b>Design/development of solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	<b>Conduct investigations of complex problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	<b>Modern tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	<b>The engineer and society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

<b>PO 9</b>	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO 10</b>	<b>Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
<b>PO 11</b>	<b>Project management and finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
<b>PO 12</b>	<b>Life-long learning:</b> Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



# INSTITUTE OF AERONAUTICAL ENGINEERING (Autonomous)

Dundigal, Hyderabad - 500 043

## DEPARTMENT OF CIVIL ENGINEERING Program: Bachelor of Technology (B. Tech)

The Program Specific outcomes (PSO's) listed below were developed specifically to meet the Program Educational Objectives (PEO's). The focus of these PSO's is consistent with the set of required PO's identified in the NBA accreditation guidelines.

The Civil Engineering PSO's require that graduates receiving a Bachelor of Technology in Civil Engineering degree from IARE demonstrate the following.

<b>PROGRAM SPECIFIC OUTCOMES (PSO's)</b>	
<b>PSO 1</b>	<b>ENGINEERING KNOWLEDGE</b> Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.
<b>PSO 2</b>	<b>BROADNESS AND DIVERSITY</b> Graduates will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage
<b>PSO 3</b>	<b>SELF-LEARNING AND SERVICE</b> Graduates will be motivated for continuous self-learning in engineering practice and/or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly.

## SURVEYING LAB II LABORATORY – SYLLABUS

Exp. No.	Name of Experiments
1.	Introduction to Advanced Surveying Laboratory
2.	Study of Theodolite in detail-practice for measurement of horizontal and vertical angles
3.	Measurement of horizontal angles by method of Repetition and Reiteration
4.	Trigonometric leveling-heights and distance problem
5.	Heights and distance using principles of Tachometric surveying
6.	Curve setting-different methods
7.	Setting out works for buildings & pipe lines
8.	Determine of area using Total Station
9.	Traversing using Total Station
10.	Contouring using Total Station
11.	Determination of Remote height using total station
12.	Stake out using total station
13.	Distance, gradient, difference in height between two inaccessible points using total station
14.	Revision

## ATTAINMENT OF PROGRAM OUTCOMES (PO's) & PROGRAM SPECIFIC OUTCOMES (PSO's)

<b>Exp No.</b>	<b>Name of Experiment</b>	<b>Program Outcomes Attained</b>	<b>Program Specific Outcomes Attained</b>
1.	Study of theodolite in detail-practice for measurement of horizontal and vertical angles	PO1(H),PO3(M),PO4(M), PO6(M), PO9(H), PO10(M)	PSO1(H), PSO2(M)
2.	Measurement of horizontal angles by method of repetition and reiteration	PO1(H), PO3(M), PO4(M),PO6(M), PO9(H), PO10(M)	PSO1(H), PSO2(M)
3.	Trigonometric leveling-heights and distance problem	PO1(H), PO3(M), PO4(M),PO6(M), PO9(H), PO10(M)	PSO1(H), PSO2(M)
4.	Heights and distance using principles of tacheometric surveying	PO1(H), PO3(M), PO4(M),PO6(M), PO9(H), PO10(M)	PSO1(H), PSO2(M)
5.	Curve setting-different methods	PO1(H), PO3(M), PO4(M),PO6(M), PO9(H), PO10(M)	PSO1(H), PSO2(M)
6.	Setting out works for buildings & pipe lines	PO1(H), PO3(M), PO4(M),PO6(M), PO9(H), PO10(M)	PSO1(H), PSO2(M)
7.	Determine of area using total station	PO1(H), PO3(M), PO4(M),PO6(M), PO9(H), PO10(M)	PSO1(H), PSO2(M)
8.	Traversing using total station	PO1(H), PO3(M), PO4(M),PO6(M), PO9(H), PO10(M)	PSO1(H), PSO2(M)
9.	Contouring using total station	PO1(H), PO3(M), PO4(M),PO6(M), PO9(H), PO10(M)	PSO1(H), PSO2(M)
10.	Determination of remote height using total station	PO1(H), PO3(M), PO4(M),PO6(M), PO9(H), PO10(M)	PSO1(H), PSO2(M)
11.	Stake out using total station	PO1(H), PO3(M), PO4(M),PO6(M), PO9(H), PO10(M)	PSO1(H), PSO2(M)
12.	Distance, gradient, difference in height between two inaccessible points using total station	PO1(H), PO3(M), PO4(M),PO6(M), PO9(H), PO10(M)	PSO1(H), PSO2(M)

## MANDATORY INSTRUCTIONS

1. Students should report to the labs concerned as per the timetable.
2. Record should be updated from time to time and the previous experiment must be signed by the faculty in charge concerned before attending the lab.
3. Students who turn up late to the labs will in no case be permitted to perform the experiment scheduled for the day.
4. After completion of the experiment, certification of the staff in-charge concerned in the observation book is necessary.
5. Students should bring a notebook of about 100 pages and should enter the readings/observations/results into the notebook while performing the experiment.
6. The record of observations along with the detailed experimental procedure of the experiment performed in the immediate previous session should be submitted and certified by the staff member in-charge.
7. Not more than FIVE students in a group are permitted to perform the experiment on a set up.
8. The group-wise division made in the beginning should be adhered to, and no mix up of student among different groups will be permitted later.
9. The components required pertaining to the experiment should be collected from Lab- in-charge after duly filling in the requisition form.
10. When the experiment is completed, students should disconnect the setup made by them, and should return all the components/instruments taken for the purpose.



11. Any damage of the equipment or burnout of components will be viewed seriously either by putting penalty or by dismissing the total group of students from the lab for the semester/year.
12. Students should be present in the labs for the total scheduled duration.
13. Students are expected to prepare thoroughly to perform the experiment before coming to Laboratory.
14. Procedure sheets/data sheets provided to the students groups should be maintained neatly and are to be returned after the experiment.
15. DRESS CODE:
  - i. Boys - Formal dress with tuck in and safety shoes.
  - ii. Girls - Formal dress (salwar kameez) and safety shoes.
  - iii. Apron in blue color for both boys and girls.
  - iv. Wearing of jeans is strictly prohibited

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## **Experiment No: 1**

### **INTRODUCTION TO ADVANCED SURVEYING LABORATORY**

Here we focus on advanced surveying laboratory which deals with the advanced and modern tool usage for practicing surveying for various purposes in day to day activities.

It mainly deals with

1. Components of vernier theodolite and the principle of measuring horizontal and vertical angles.
2. Indirect measurement of measuring horizontal distances using the principle of trigonometric survey.
3. Measurement of reduced level of an inaccessible points whose base is accessible and inaccessible conditions using the principle of tacheometric surveying.
4. Setting out of curves and design of curves by different methods
5. Determination of an area using advanced surveying instruments i.e. total station
6. Determination of remote height, contouring, calculation of distance, gradient and difference in elevation between any two points using the principle of advanced surveying.

## Experiment No: 2

### STUDY OF THEODOLITE IN DETAIL-PRACTICE FOR MEASUREMENT OF HORIZONTAL AND VERTICAL ANGLES

#### 1.1 OBJECTIVE:

#### THE THEODOLITE:

The theodolite is the most intricate and accurate instrument used for measuring horizontal and vertical angles. It consists of a telescope by means of which distant objects can be sighted. The telescope has two distinct motions one in the horizontal plane and the other in the vertical plane, the former being measured on a graduated horizontal circle by means of a set of vertical and the latter on a graduated vertical circle by two verniers. It can also be used for various other purposes such as laying off horizontal angles, locating points on a line, prolonging survey lines, establishing grades, determining difference in elevations.

Theodolites may be primarily classified as (i) Transit theodolite  
(ii) Non-transit Theodolite

A theodolite is called a transit theodolite, when its telescope can be revolved through a complete revolution about its horizontal axis in a vertical plane.

#### 1.2 RESOURCES:

S.no	Name of the equipment	Range	Type	Quantity
1	Theodolite			1

## **1.3 PRECAUTIONS**

### **THE TRANSIT THEODOLITE:**

A transit theodolite or simply a transit essentially consists of the following

(1) **THE LEVELLING HEAD :**

It may be consists of (i) two circular plates called parallel plates kept at a fixed distance apart by a ball and socket arrangements and three or four screws called levelling or foot screws or (ii) a tribranch plate with three arms, each carrying a levelling screw.

The lower parallel plate has a central aperture through which a plumb bob may be suspended. The upper plate or the tribranch is supported by means of four or three levelling screws by which the instrument may be levelled.

(2) **THE TWO SPINDLES :**

There are two spindles or axes (also called centre) one inside the other. The outer axis is hollow and its interior is ground conical to fit the central vertical axis, called the inner axis, which is solid & conical. It is essential that the two axes should be co-axial i.e. have a common axis which forms the vertical axis of the instrument.

(3) **THE LOWER PLATE :**

The outer axis is attached to the lower plate, also called the scale plate, having its edge beveled. The edge (or limb) is silvered i.e. covered with silver) and graduated from 0 to 360 in clockwise direction. The horizontal circle may be graduated to (i) deg. & half deg. (ii) deg. & 1/3 deg. (iii) degrees & 1/6 deg., depending upon the size of the instrument example 10 cm, 12 cm etc., the lower plate is provided with a clamp and tangent or slow motion screw by means of which it can be fixed accurately at any desired position. When the clamp screw is tightened, the lower plate is fixed to the upper tribranch (or parallel plate) and on turning the tangent screw, the lower plate and with it the upper part of the instrument are rotated slightly.

(4) **THE UPPER PLATE :**

The upper plate, also called the vernier plate is attached to the inner axis. A clamp and tangent or slow motion screw are provided for the purpose of accurately fixing the vernier

plate to the scale plate. When both plates are clamped together and the lower clamp is loosened, the inner axis. Before either of the tangent screw is turned, the corresponding clamp must be tightened. The upper plate carries two verniers with magnifiers placed  $180^{\circ}$  apart (in large instrument, three verniers placed  $120^{\circ}$  apart) for reading horizontal angles to one min., to  $20''$ .

The vernier plate complete with the standards and telescope is sometimes called the alidade of the theodolite.

(5) **THE LEVEL TUBES :**

Two spirit level called the plate levels placed at right angles to each other are fixed on the upper surface of the vernier plate for levelling the instrument of the two plate levels, one is parallel to the horizontal axis.

(6) **THE STANDARDS :**

Two uprights called standards or A frames (resembling 'A' in shape) stand upon the vernier plate to support the horizontal axis.

(7) **THE COMPASS :**

The compass box may be either of a circular form or of a through type. The former is mounted on the vernier plate between the standards, while the latter is either attached to the underside of the scale or lower plate or screwed to one of the standards. Modern Theodolite are fitted with a compass of the tabular type and it is screwed to one of the standards.

(8) **THE TELESCOPE :**

The telescope is rigidly fixed at the centre of and at right angles to the horizontal axis.

(9) **THE VERTICAL CIRCLE :**

The vertical circle is rigidly attached to the telescope and moves with it. It is silvered and is usually divided in four quadrants, but in some instrument it is graduated continuously clockwise from  $0^{\circ}$  to  $360^{\circ}$ . The graduations in each quadrant are numbered from  $0^{\circ}$  to  $90^{\circ}$  in opp., directions from the two zeros placed at the ends of the horizontal dia., of the vertical circle so that the line of collimation of telescope when it is horizontal. The sub-divisions of the vertical circle clamp and tangent screw, telescope and with it the vertical circle can be accurately set up at any desired position in a vertical plane.

(10) **THE INDEX BAR (OR T FRAME) :**

The index bar is T-shaped and centered on the horizontal axis of the telescope in front of the

vertical circle. It carries two verniers at the extremities of its horizontal arms or limbs called the clipping arm is provided with a fork and two screws called the clip or clipping screws at its lower extremity. By means of these screws, it is secured to a piece of metal projecting from the crossbar of either A support. The index arm and the clipping arm are together known as the 'T' frame. A long sensitive bubble tube called the altitude or azimuthal bubble tubes attached to the top of the frame. It can be centered by means of the clip screws. In some instrument it is set on the top of the telescope.

### **THE PLUMB BOB :**

To centre the instrument exactly over a station mark, a plumb-bob is suspended from the hook fitted to the bottom of the central vertical axis.

### **THE COMPASS :**

The compass fitted on Theodolite may be (i) the circular box compass (ii) the through compass or (iii) the tubular compass.

### **TRIPOD :**

The theodolite is supported on a tripod when on use. The tripod consists of three legs, which may be solid framed for lightness. The legs are fitted at their lower ends with pointed steel shoes in order that they may be firmly pressed into ground. Any looseness in joints will disturb the position of instrument leading to inaccurate work. The tripod head carries at its upper surface an external screw to which the internal screw of the instrument may be fitted. When the tripod is not in use, the cap is screwed to protect the external screw from injury.

### **CONDITIONS OF ADJUSTMENT :**

When the transit is in perfect adjustment, the following relations between the fundamental lines should exist :

Axis of

- ❖ Axis of level plates must be  $\frac{1}{2}$  vertical axis
- ❖ Line of collimation should be at right angles to horizontal axis
- ❖ Horizontal axis must be  $\frac{1}{2}$  vertical axis
- ❖ Axis of telescope level or altitude level must be parallel to the line of collimation
- ❖ If the transit has a fixed vertical vernier, the vertical circle must read zero when the telescope level is centered



- ❖ If the transit is provided with a striding level, the axis of the striding level must be parallel to the horizontal axis.

The above relations are permanent adjustments of telescope and they remain permanent for considerable amount of time.

There are 3 important temporary adjustments

**(a) SETTING UP :**

It includes two operations

- ❖ Centering a theodolite over a station
- ❖ Levelling it approximate by tripod legs only

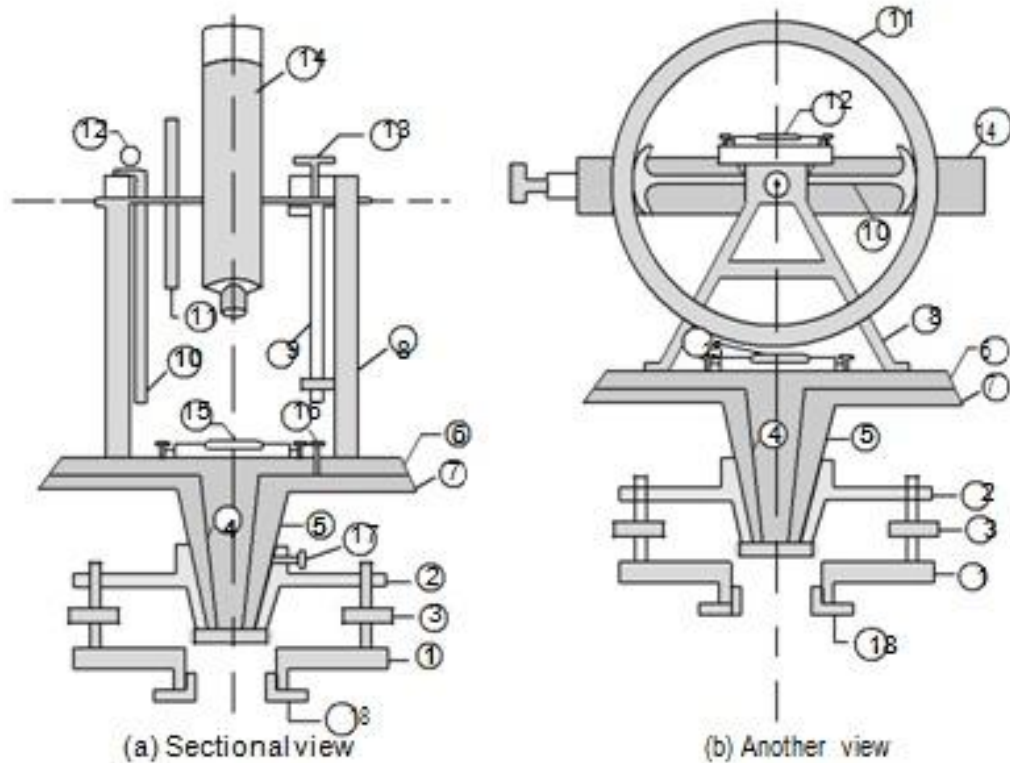
**(b) LEVELLING :**

It is levelling accurately with reference to the plate levels by means of levelling (or foot) screws so the vertical axis shall be truly vertical.

**(c) ELIMINATION OF PARALLAX :**

Accurate work is impossible if parallax is not eliminated. To eliminate it, the image formed by the objective, must lie in the plane of the cross-hairs. It is done in two steps

- ❖ Focusing eye piece : The object of focusing eye piece is to make cross-hairs distinct and clear
- ❖ Focusing objective: The object of focusing the object glass in the plane of cross-hairs. Otherwise there will be an apparent movement of image relative to the cross-hairs when the observer moves the eye.



- |                  |                              |                           |
|------------------|------------------------------|---------------------------|
| 1. Trivet        | 7. Circle plate              | 13. Vertical circle clamp |
| 2. Tribrach      | 8. A-frame                   | 14. Telescope             |
| 3. Foot screw    | 9. Vertical circle clamp arm | 15. Plate bubble          |
| 4. Inner axis    | 10. Vernier frame            | 16. Upper clamp           |
| 5. Outer axis    | 11. Vertical circle          | 17. Lower clamp           |
| 6. Vernier plate | 12. Altitude bubble          | 18. Tripod head           |

#### 1.4 PRE LAB QUESTIONS:

1. What are the fundamental parts of a Theodolite?
2. What are the fundamental lines in a Theodolite?
3. What is meant by size of a Theodolite? What's it?
4. What is the difference between a level and a Theodolite?

## **1.5 LAB ASSGNMENT :**

Detail study on Theodolite and parts

## **1.6 POST LAB QUESTIONS:**

- 1. What are the types of telescopes used in survey?**
- 2. What is the internal focusing telescope?**
- 3. What is the external focusing telescope?**

### Experiment No: 3

## MEASUREMENT OF HORIZONTAL ANGLE BY THE METHOD OF REPETITION AND REITERATION

### 1.1 OBJECTIVE:

Measurement of horizontal angle by the method of repetition and reiteration

### 1.2 RESOURCES:

S.no	Name of the equipment	Rage	Type	Quantity
1	Theodolite			1
2	Taps			1
3	Arrows			4
4	Ranging rods			4
5	Tripod			1

### 1.3 PERCAUTIONS

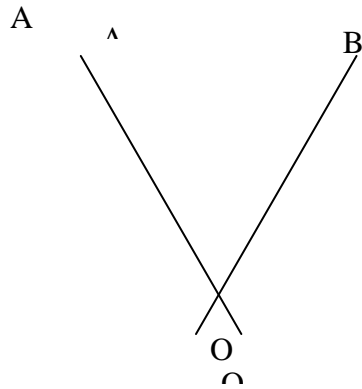
- a) Temporary adjustment for Theodolite
- b) Leveling and centering
- c) Focusing adjustment
- d)

### 1.4 PROCEDURE:

- 1) Set up the instrument over 'O' and level it accurately.
- 2) With the instrument on the left face, set verniers A to 3600 and with the aid of the lower clamp and tangent screw, bisect signal A.
- 3) Check the reading on verniers A&B and note it.
- 4) Release the upper plate, swing the telescope to the right and bisect the right hand signal B with the upper clamp and tangent screw bisects single A.
- 5) Release the lower clamp, swing instrument to the right and turn to signal A. Clamp the lower motion and with lower tangent screw bisect signal A.
- 6) Release upper clamp, swing instrument to the right and again bisect signal B accurately with the upper clamp and tangent screw. The vernier reading will be twice the angle AOB.

- 7) Repeat the procedure until the angle is repeated the required number of times.
- 8) Change face to right and repeat the above procedure.
- 9) The average horizontal angle AOB will be the mean of the value of the angle as determined on both the faces.

**1.5 DIAGRAM:**



**1.6 TABULATION:**

Inst at	Sight to	Face Right		Right Swing		Face Left		Left Swing	
		A Vernier	B Vernier	Mean	Included Horizontal angle	A Vernier	B Vernier	Mean	Included Horizontal angle
		° ' "	° ' "	° ' "	° ' "	° ' "	° ' "	° ' "	° ' "

## **1.7 RESULTS**

The following horizontal angles are measured:

## **1.8 PRE LAB QUESTIONS:**

1. What are the measures carried out for instrument set up?
2. What is centering?
3. How are cross hairs placed in the telescope?

## **1.9 LAB ASSIGNMENT :**

Measurement of horizontal angle taking 2 points.

## **1.10 POST LAB QUESTIONS:**

1. What is transit Theodolite?
2. What is face left?
3. What is face right?

## **MEASUREMENT OF HORIZONTAL ANGLES BY REITERATION**

### **1.1 OBJECTIVE:**

Measurement of horizontal angle by the method of repetition

### **1.2 RESOURCES:**

S.no	Name of the equipment	Rate	type	quantity
1	Theodolite			1
2	Taps			1
3	Arrows			4
4	Ranging rods			4
5	Tripod			1

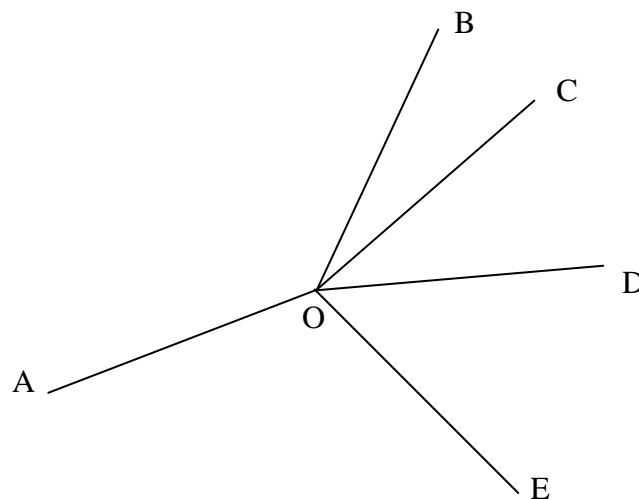
### **1.3 PERCAUTIONS**

- a) **Temporary adjustment for Theodolite**
- b) **Leveling and centering**
- c) **Focusing adjustment**

### **1.4 PROCEDURE**

- 1) Set up the instrument exactly over O and level it accurately.
- 2) Let signal A be the referring object. Direct the telescope to A and bisect it with the help of the lower clamp and tangent screw. Note the reading of both the verniers.
- 3) Release the upper plate and turn the telescope clock wise and bisect signal B accurately with the help of the upper clamp and tangent screw. Note the readings of verniers A&B. their mean gives the angle AOB.
- 4) Similarly bisect signals C, D etc. in order using the upper clamp and tangent screw and each time note the reading on verniers A&B.
- 5) Finally site referring object A. if the final reading on signal A is the same as the initial reading, there is no error. Otherwise the error should be distributed equally among all the angles observed at the station if it is within permissible limits. If the error is large the readings have to be taken fresh.

### **1.5 DIAGRAM:**



**1.6 TABULATION:**

Inst at.	Sight to	Right Face		Right Swing		Left Face		Left Swing		Name of the angle
		A	B	Mean	Included angle	A	B	Mean	Included angle	
		° ‘ “	° ‘ “	° ‘ “	° ‘ “	° ‘ “	° ‘ “	° ‘ “	° ‘ “	
						“	“			

**1.7 RESULTS**

The following horizontal angles are measured:

**1.8 PRE LAB QUESTIONS:**

1. How to measure measurement of horizontal Angles?
2. What are the uses of upper clamp?
3. What are the uses of lower clamp?



## **1.9 LAB ASSIGNMENT**

Measurement of horizontal angle by the method of repetition more than 5 stations

## **1.10 POST LAB QUESTION**

1. What is face left?
2. What is face right?
3. Explain the procedure for Measurement of Horizontal Angles by Reiteration.

## Experiment No: 4

### TRIGNOMETRIC LEVELING – HEIGHTS AND DISTANCES PROBLEM

#### ELEVATION OF AN INACCESSIBLE POINT WHOSE BASE IS ACCESSIBLE

In order to determine the elevation of the point of a chimney or church spire etc. whose base is accessible proceed as follows:

##### 1.1 OBJECTIVE:

To determine the Elevation of an inaccessible point whose base is accessible.

##### 1.2 RESOURCES:

S.no	Name of the equipment	Rage	type	quantity
1	Theodolite			1
2	Taps			1
3	Arrows			4
4	Ranging rods			4
5	Tripod			1

##### 1.3 PERCAUTIONS

- a) Temporary adjustment for Theodolite
- b) Leveling and centering
- c) Focusing adjustment

##### 1.4 PROCEDURE

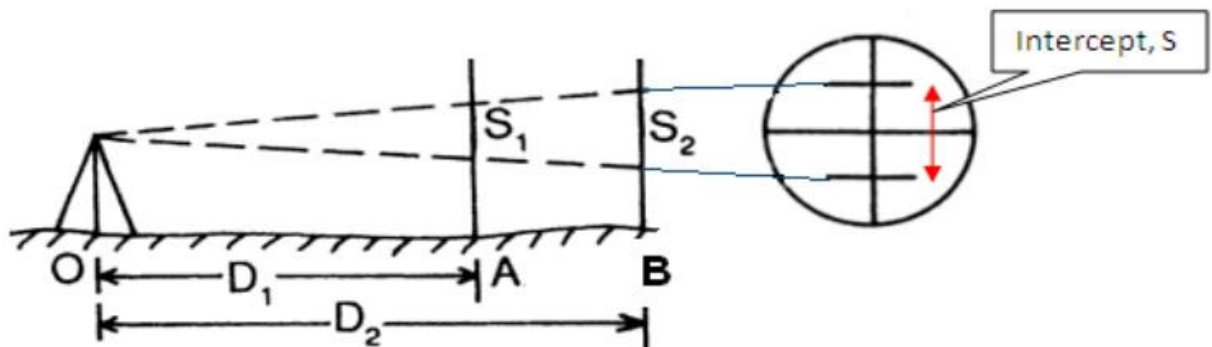
Let A be the inaccessible point whose elevation is required.

Let B be its projection on the ground which is accessible,

- 1) Set up the Theodolite at c at a distance of say D meters from B and level it accurately by the altitude level.

- 2) Sight to point A and observe the vertical angle  $\alpha$  subtended at the line of collimation, both on face left and face right and take the average of the two values.
- 3) Measure the horizontal distance BC accurately by tape.
- 4) With the line of sight horizontal, take a staff reading h on the bench mark established nearby the instrument.

### 1.5 DIAGRAM:



### 1.6 OBSERVATIONS AND CALCULATIONS:

$$AE = D \tan \alpha$$

$$\text{R.L of A} = \text{R.L of BM} + h + D \tan \alpha$$

If the distance D is large, combined correction for curvature and refraction has to be applied.

$$\text{Then, R.L of A} = \text{R.L of B.M} + h + D \tan \alpha - 0.0673(D/1000)^2$$

### 1.6 RESULTS

**1.7 PRE LAB QUESTIONS:**

- 1. What is Tacheometric leveling?**
- 2. How are the cross hairs in the Tacheometric?**

**1.8 LAB ASSIGNMENT**

Determine the Elevation of an inaccessible point whose base is accessible tv tower

**1.9 POST LAB QUESTIONS:**

- 1. What are stadia reading?**
- 2. Explain the procedure?**
- 3. What is stadia intercept?**

## **ELEVATION OF AN INACCESSIBLE POINT WHEN BASE IS INACCESSIBLE**

### **1.1 OBJECTIVE:**

To determine the Elevation of an inaccessible point when base is inaccessible

### **1.2 RESOURCES:**

<b>S.no</b>	<b>Name of the equipment</b>	<b>Rage</b>	<b>type</b>	<b>quantity</b>
1	Theodolite			1
2	Taps			1
3	Arrows			4
4	Ranging rods			4
5	Tripod			1

### **1.3 PERCAUTIONS**

- a) **Temporary adjustment for Theodolite**
- b) **Leveling and centering**
- c) **Focusing adjustment**

### **1.4 PROCEDURE**

Let A be the inaccessible point A whose elevation is to be determined

- 1) Set up the theodolite at station B at a convenient position so that the object A can be sighted and level the instrument accurately by the altitude level.
- 2) Sight the object and read the vertical angle  $EB'A = \alpha$ .
- 3) With both motions of plates clamped, plunge the telescope and mark a station C in the line of sight at a suitable distance d from B so that points, A, B, C lie in the same vertical plane.
- 4) With line of sight horizontal, take the staff readings  $s_1$  on a nearby B.M. to establish the R.L. of the plane of collimation.
- 5) Shift the instrument and set it up exactly over C and level it accurately.

6) With line of sight horizontal, take the staff reading  $s_2$  on the B.M. to establish the level of plane of collimation at C.

7) Sight object A, bisect it accurately and read the vertical angle  $\alpha_2$  to A from C,

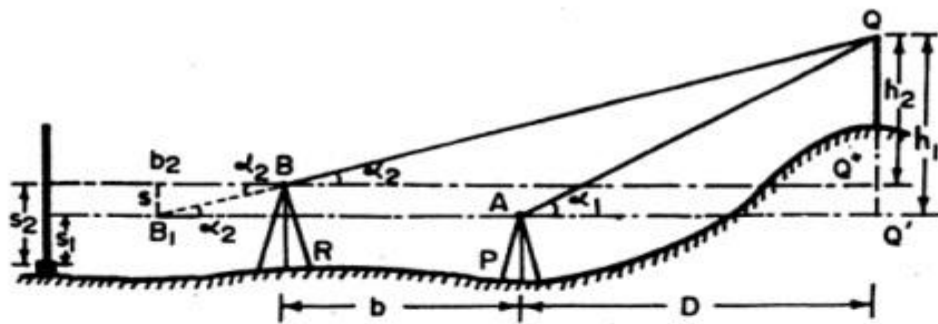
$$h = AE \cdot \tan \alpha_1$$

$$h = (h_1 + d \tan \alpha_2) \tan \alpha_1 / \tan \alpha_1 - \tan \alpha_2$$

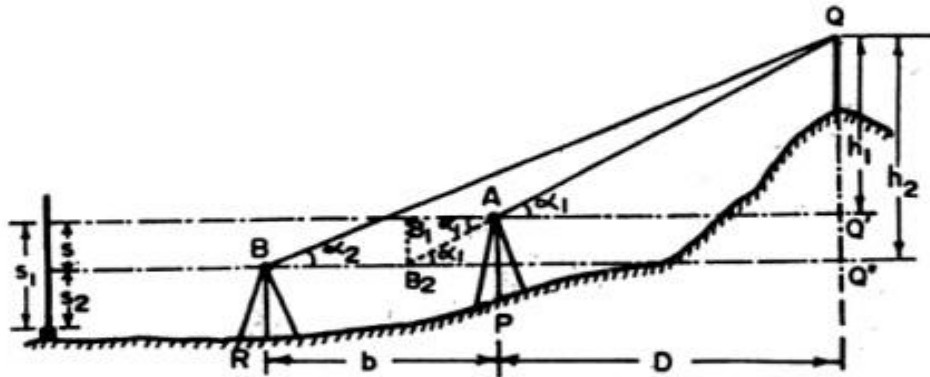
$$\text{R.L. of A} = \text{R.L. of B.M.} + \text{staff reading } s_1 + h$$

Note: if line of collimation is higher at B than at C, value of  $d$  must be taken as negative.

### 1.5 DIAGRAM:



When P is Lower than R



When P is higher than R

$$D = \frac{(b \pm s \cot \alpha_2) \tan \alpha_2}{\tan \alpha_1 - \tan \alpha_2}$$

Use + sign with  $s \cot \alpha_2$  when the instrument axis at A is lower and - sign when it is higher than at B.

$$\text{R.L. of } Q = \text{R.L. of B.M.} + s_1 + h_1$$

$$h_1 = D \tan \alpha_1$$

### 1.6 TABULATION:

Inst. Station	Height of axis	Staff Stations	Vertical Angle	Hair readings	Remarks

$$h = AE \cdot \tan \alpha_1$$

$$h = (h_1 + d \tan \alpha_2) \tan \alpha_1 / \tan \alpha_1 - \tan \alpha_2$$

$$R.L \text{ of A} = R.L \text{ of B.M} + \text{staff reading } s_1 + h$$

### 1.7 RESULTS

Stadia intercept values top ----- middle ----- bottom-----

### 1.8 PRE LAB QUESTIONS:

1. What is tacheometric leveling?
2. How are the cross hairs in the tacheometric?

### 1.9 LAB ASSIGNMENT

Determine the Elevation of an inaccessible point whose base is accessible tv tower

### 1.10 POST LAB QUESTIONS:

1. What are stadia reading?
2. Explain the procedure?
3. What is stadia intercept?

**Experiment No: 5**  
**CURVE SETTING - DIFFERENT METHODS**

**1.1 OBJECTIVE:**

Setting the curve by Rankine's method of deflection angle

**1.2 RESOURCES:**

S.no	Name of the equipment	Rage	type	quantity
1	Theodolite			1
2	Taps			1
3	Arrows			4
4	Ranging rods			4
5	Tripod			1

**1.3 PERCAUTIONS**

- a) Temporary adjustment for Theodolite
- b) Leveling and centering
- c) Focusing adjustment

**1.4 PROCEDURE**

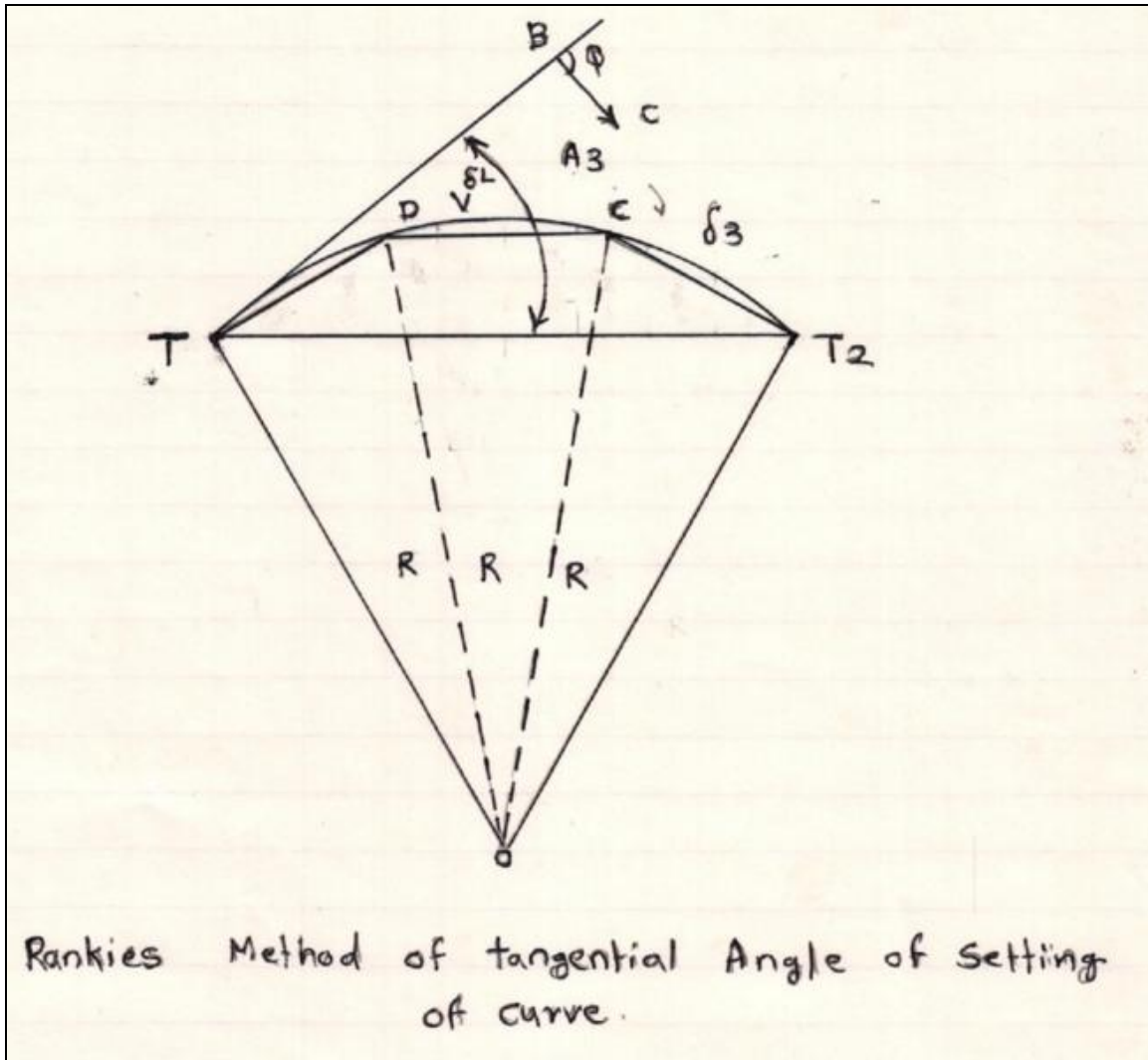
- 1) Locate P.C. (T1), P.T (T2) and P.I. (I).
- 2) Set up the theodolite exactly at T1 and make its temporary adjustments.
- 3) Set up vernier A to zero and bisect the P.I Clamp the lower plate.
- 4) Release the upper plate and set the vernier A to read  $\Delta 1$ . The line of sight is thus directed along T1a.
- 5) Hold the zero 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 in the curve.
- 6) Set the second deflection angle  $\Delta 2$ . On the scale so that lime of sight is set along T1b. 7) With zero of the of the tape held at a and an arrow at the other end (chord distance= $ab$ ), swing the tape

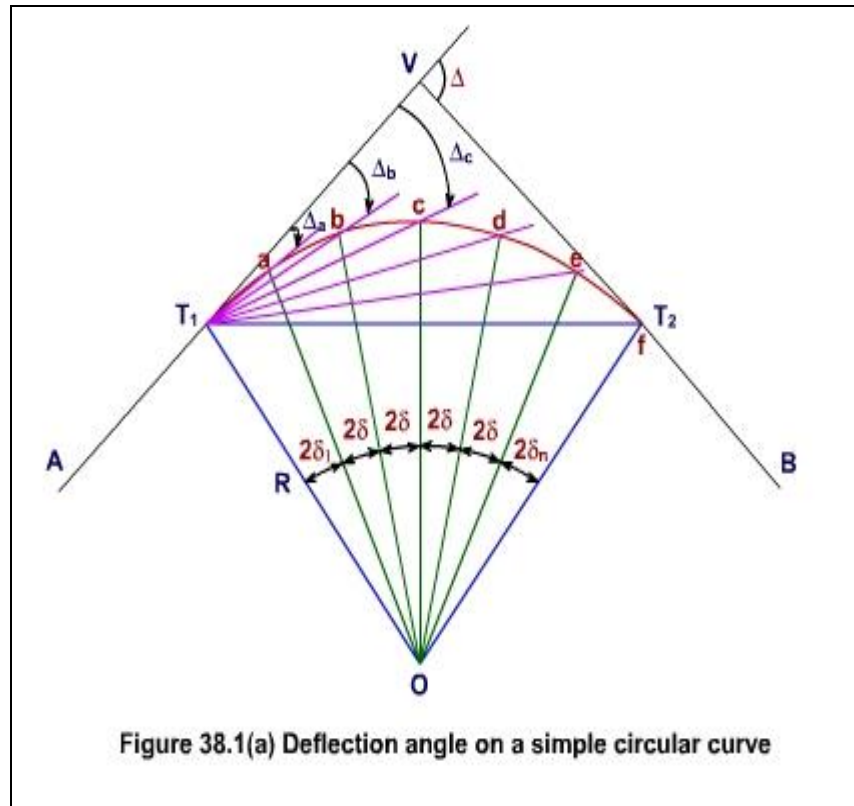


about a, till the arrow is bisected by the theodolite at b, this establishes the second point b on the curve.

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

**1.5 DIAGRAM:**





## 1.6 CALCULATION

Now, for the first tangential angle  $\delta_1$ , from the property of a circle

$$\text{Arc } T_1 a = R \times 2\delta_1 \text{ radians}$$

Assuming the length of the arc is same as that of its chord, if  $C_1$  is the length of the first chord i.e., chord  $T_1 a$ , then

$$\begin{aligned} \delta_1 &= \frac{C_1}{2R} \text{ radians} \\ &= \frac{180^\circ C_1}{2\pi R} \text{ degrees} \\ &= \frac{180 \times 60 C_1}{2\pi R} \text{ minutes} \\ &= 1718.9 \frac{C_1}{R} \text{ minutes} \end{aligned}$$

(Note: the units of measurement of chord and that of the radius of the curve should be same).

Similarly, tangential angles for chords of nominal length, say  $C$ ,

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

And for last chord of length, say  $C_n$

$$\delta_n = 1718.9 \frac{C^n}{R} \text{ minutes}$$

The deflection angles for the different points a, b, c, etc. can be obtained from the tangential angles. For the first point a, the deflection angle  $\Delta_a$  is equal to the tangential angle of the chord to this point i.e.,  $\delta_1$ . Thus,

$$\Delta_a = \delta_1.$$

The deflection angle to the next point i.e., b is  $\Delta_b$  for which the chord length is T<sub>1</sub> b. Thus, the deflection angle

$$\begin{aligned} \Delta_b &= -\angle T_1 O b \\ &= -\frac{1}{2}(2\delta_1 + 2\delta) \\ &= \Delta_a + \delta \end{aligned}$$

$$\begin{aligned} \text{Similarly, } \Delta_c &= -\angle T_1 O c \\ &= -\frac{1}{2}(2\delta_1 + 2\delta + 2\delta) \\ &= \Delta_b + \delta \end{aligned}$$

$$\text{Like wise, } \Delta_n = \Delta_{n-1} + \delta_n$$

Thus, the deflection angle for any point on the curve is the deflection angle upto previous point plus the tangential angle at the previous point.

## **1.7 RESULTS**

Setting the curve by Rankine's method of deflection angle  
by Rankine's method of deflection angle and curve is formed

## **1.8 PRE LAB QUESTIONS:**

- 1. Define curve.**
- 2. What is a chord, how it is formed?**
- 3. What does the Rankine's method say?**

## **1.9 LAB ASSIGNMENT**

Setting the curve by given two points T1 and T2

### **1.10 POST LAB QUESTIONS:**

- 1. Procedure for curve settings**
- 2. What are the deflection angles in the curve?**

## Two Theodolite methods

### 1.1 OBJECTIVE:

Setting the curve by two - Theodolite method.

### 1.2 RESOURCES:

Sl.No.	Name of the equipment	Rage	type	quantity
1	Theodolite			1
2	Taps			1
3	Arrows			4
4	Ranging rods			4
5	Tripod			1

### 1.3 PERCAUTIONS

- a) Temporary adjustment for Theodolite
- b) Leveling and centering
- c) Focusing adjustment

### 1.4 PROCEDURE

- 1) Set up one Theodolite at P.C (T1) and the other at P.T (T2).
- 2) Set the vernier A of both the Theodolite to zero.
- 3) Direct the Theodolite at T1 towards I, and the Theodolite at T2 towards T1.
- 4) set angle  $\partial 1$  in both the Theodolite so as to direct the line of sights towards T1a and T2a, thus the point a, the point of intersection of the two line of sights, is established on the curve.
- 5) Similarly, point b is established by setting  $\partial 2$  in both the theodolites and bisecting the ranging rod at b.
- 6) The same steps are repeated with different values of  $\partial$  to establish more points. This method is expensive and time consuming, but more accurate.

1.5 DIAGRAM:

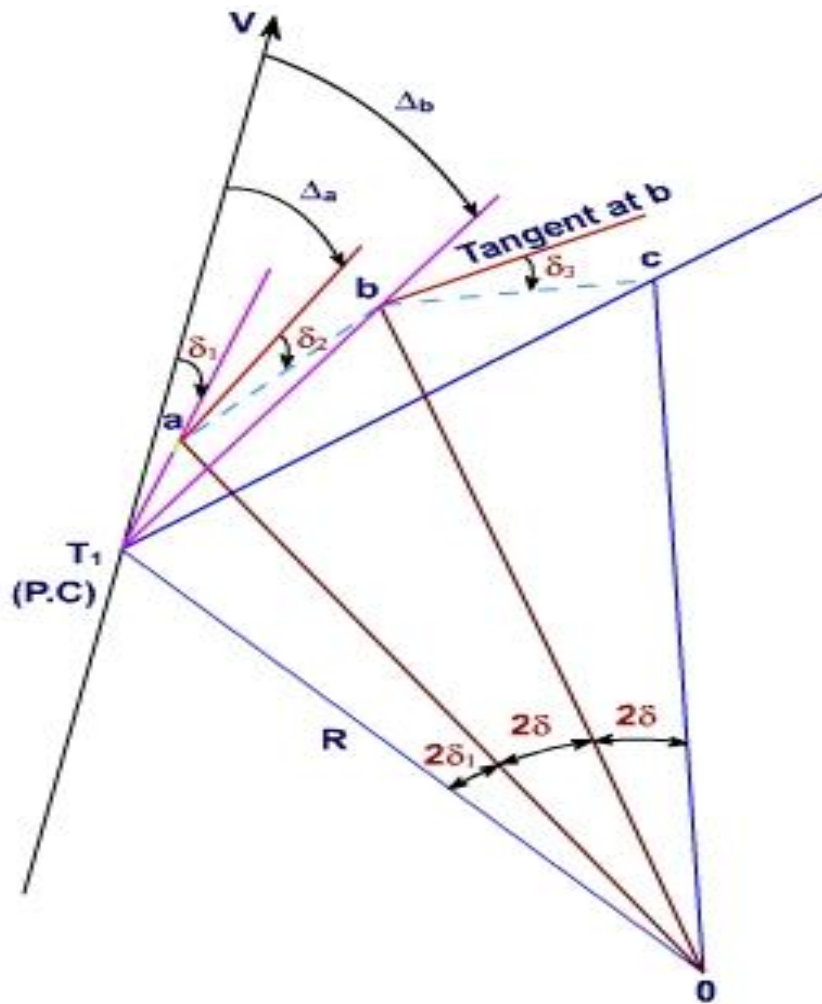


Figure 38.1(b) Laying out of a circular curve by deflection angle (Rankine's method)

## 1.6 Calculation :

Now, for the first tangential angle  $\delta_1$ , from the property of a circle

$$\text{Arc } T_1 a = R \times 2\delta_1 \text{ radians}$$

Assuming the length of the arc is same as that of its chord, if  $C_1$  is the length of the first chord i.e., chord  $T_1 a$ , then

$$\begin{aligned} \delta_1 &= \frac{C_1}{2R} \text{ radians} \\ &= \frac{180^\circ C_1}{2\pi R} \text{ degrees} \\ &= \frac{180 \times 60 C_1}{2\pi R} \text{ minutes} \\ &= 1718.9 \frac{C_1}{R} \text{ minutes} \end{aligned}$$

(Note: the units of measurement of chord and that of the radius of the curve should be same).

Similarly, tangential angles for chords of nominal length, say  $C$ ,

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

And for last chord of length, say  $C_n$

$$\delta_n = 1718.9 \frac{C_n}{R} \text{ minutes}$$

The deflection angles for the different points a, b, c, etc. can be obtained from the tangential angles. For the first point a, the deflection angle  $\Delta_a$  is equal to the tangential angle of the chord to this point i.e.,  $\delta_1$ . Thus,

$$\Delta_a = \delta_1.$$

The deflection angle to the next point i.e., b is  $\Delta_b$  for which the chord length is  $T_1 b$ . Thus, the deflection angle

$$\begin{aligned} \Delta_b &= \frac{1}{2} \angle T_1 O b \\ &= \frac{1}{2} (2\delta_1 + 2\delta) \\ &= \Delta_a + \delta \end{aligned}$$

$$\begin{aligned} \text{Similarly, } \Delta_c &= \frac{1}{2} \angle T_1 O c \\ &= \frac{1}{2} (2\delta_1 + 2\delta + 2\delta) \\ &= \Delta_b + \delta \end{aligned}$$

$$\text{Like wise, } \Delta_n = \Delta_{n-1} + \delta_n$$

Thus, the deflection angle for any point on the curve is the deflection angle upto previous point plus the tangential angle at the previous point.

## **1.7 RESULTS**

Setting the curve by Rankine's method of deflection angle  
by Rankine's method of deflection angle and curve is formed

## **1.8 PRE LAB QUESTIONS:**

- 1. Define curve**
- 2. What is a chord, how it is formed**
- 3. What does the Rankine's method say**

## **1.9 LAB ASSIGNMENT**

Setting the curve by given two points T1 and T2

## **1.10 POST LAB QUESTIONS:**

- 1. Procedure for curve settings**
- 2. What are the deflection angles in the curve?**



## Experiment No: 6

### SETTING OUT WORKS FOR BUILDING AND PIPE LINES

#### 1.1 OBJECTIVE:

To set out building points and pipe line points on ground using total station.

#### 1.2 RESOURCES:

Sl.No.	Name of the equipment	Rage	Type	Quantity
1	Total station			1
2	Prism			1
3	Tripod			4

#### 1.3 PERCAUTIONS

- a) Temporary adjustment for total station
- b) Leveling and centering
- c) Focusing adjustment

#### 1.4 PROCEDURE

Pentax Total Station setting out is the establishment of points & lines to define the position & level of elements of the construction work so that works may proceed with reference to them. The main aim of setting out is to ensure that the various points are positioned correctly in all three dimensions.

##### 1. Building Set out:

1. Building dimensions usually obtained from architects plans.
2. Fix the total station over a control point and level it accurately. This must be done correctly otherwise the subsequent readings taken with the instrument will not give the correct results.
3. Orient it horizontally to the site coordinate system and it may also have to be orientated vertically. For horizontal orientation, the coordinates of the control point at which the instrument is set up are entered into the total station.

4. An adjacent control point is then chosen as a reference point (Reference Object) and the coordinates for this site are also keyed in. To orientate the total station, the RO is sighted and the horizontal circle orientation programme automatically computes the bearing from the total station to the RO.
5. Once the total station has been orientated it can be used for setting out horizontal positions either using the coordinates of the points to be set out directly or using bearing and distance values calculated from these coordinates.
6. Setting out a building to ground-floor level falls into the first category of setting out.
7. Two corners of the building are set out from a baseline, site grid or control points.
8. From these two corners, the two other corners are set out using a Total Station to turn off the right angles as shown below. Diagonals are checked.

## **2 Pipeline Set out:**

1. Setting out a pipeline falls into the first category of setting out. sewers normally follow the natural fall in the land and are laid at gradients which induce self-cleansing velocity.
2. The working drawings will show the directions of the sewer pipes and the positions of the manholes. The line of the sewer is normally pegged at 20 to 30m intervals using coordinate methods of positioning from reference points or in relation to existing detail. The direction of the line can be sighted using Total station.
3. Fix the total station over a control point and level it accurately. The coordinates of the control point at which the instrument is set up are entered into the total station.
4. Determine the sewer line points with reference to the control points by horizontal positioning method.

### **1.1 RESULTS**

Building points and pipe line points on ground are established

### **1.2 PRE LAB QUESTIONS:**

- 1. What is the temporary adjustment for total station?**
- 2. What is the instrument used for ranging**

### **1.3 LAB ASSGNMENT**

To set out building points and pipe line points on ground using total station

### **1.4 POST LAB QUESTIONS:**

- 1. What Total station operations**
- 2. What is the command we use for horizontal station**

## Experiment No: 7

### DETERMINATION OF AREA USING TOTAL STATION

#### 1.1 OBJECTIVE:

To find the area of a closed traverse using total station

#### 1.2 RESOURCES:

Sl.No.	Name of the equipment	Rage	Type	Quantity
1	Total station			1
2	Prism			1
3	Tripod			1
4	Pegs			

#### 1.3 PERCAUTIONS

- d) Temporary adjustment for total station
- e) Leveling and centering
- f) Focusing adjustment

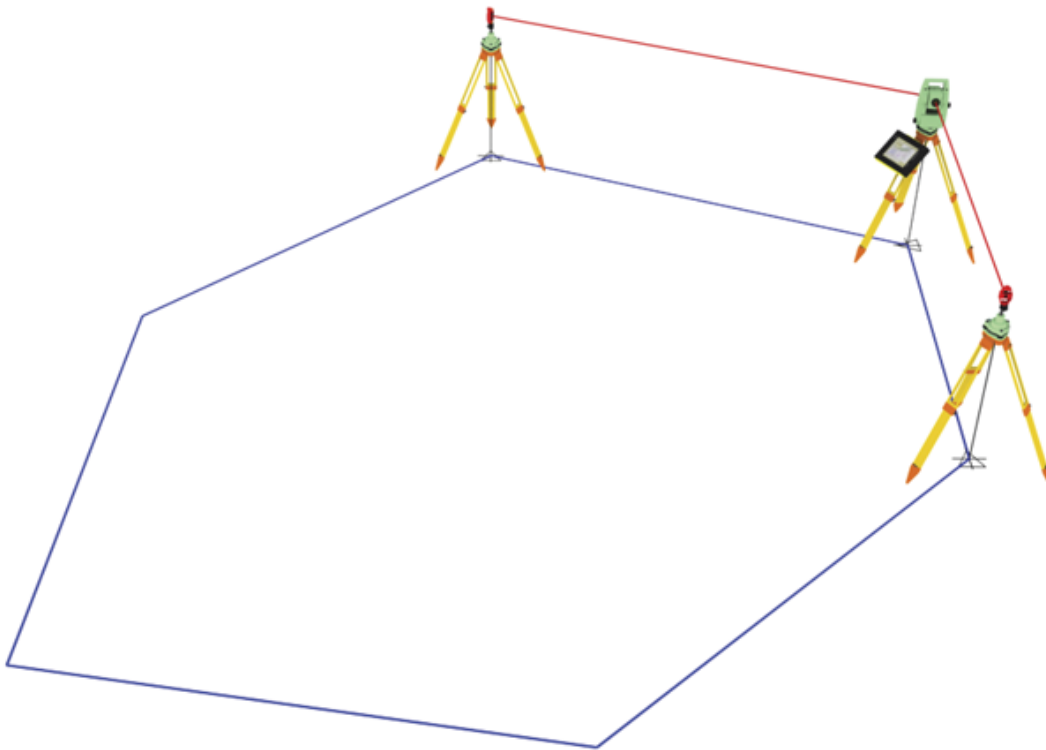
#### 1.4 PROCEDURE

1. Fix the total station over a station and level it
2. Press the power button to switch on the instrument.
3. Select MODE B -----> S function----->file management----->create(enter a name)----->accept
4. Then press ESC to go to the starting page
5. Then set zero by double clicking on 0 set(F3)
6. Then go to S function -----> measure-----> rectangular co-ordinate---->station --- >press enter.
7. Here enter the point number or name, instrument height and prism code.

PN .....
E.....
N.....
IH.....
PC.....

8. Then press accept (Fs)
9. Keep the reflecting prism on the first point and turn the total station to the prism, focus it and bisect it exactly using horizontal and vertical clamps.
10. Then select MEAS and the display panel will show the point specification
11. Now select edit and re-enter the point number or name point code and enter the prism height that we have set.
12. Then press MEAS/SAVE (F3) so that the measurement to the first point will automatically be saved and the display panel will show the second point.
13. Then turn the total station to second point and do the same procedure.
14. Repeat the steps to the rest of the stations and close the traverse
15. Now go to S function----> view/edit----graphical view.
16. It will show the graphical view of the traverse.
17. Select S function---> calculation---> 2D surface----> All-----> accept
18. This will give the area of the closed traverse.

### 1.5 DIAGRAM:



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### 1.6 Calculation :

Select S function---> calculation---> 2D surface----> All-----> accept

### 1.7 RESULTS

Select S function---> calculation---> 2D surface----> All-----> accept

This will give the area of the. Area of the is calculated.

### 1.8 PRE LAB QUESTIONS:

1. What is the temporary adjustment for total station?
2. What is the instrument used for ranging

## **1.9 LAB ASSIGNMENT**

To find the area of a closed traverse using stations by using total station

### **1.10 POST LAB QUESTIONS:**

- 1. What Total station operations**
- 2. What is the command we use for horizontal station**

**Experiment No: 8**  
**TRAVERSING USING TOTAL STATION**

**1.1 OBJECTIVE:**

To form a closed traverse using total station

**1.2 RESOURCES:**

S.No.	Name of the equipment	Rage	Type	Quantity
1	Total station			1
2	Prism			1
3	Tripod			1
4	Pegs			

**1.3 PERCAUTIONS**

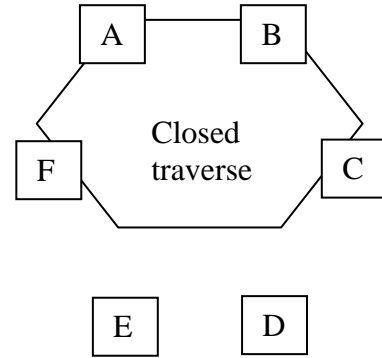
- g) Temporary adjustment for total station**
- h) Leveling and centering**
- i) Focusing adjustment**

**1.4 PROCEDURE**

1. Fix the total station over a station and level it
2. Press the power button to switch on the instrument.
3. Select MODE B -----> S function----->file management----->create(enter a name)----->accept
4. Then press ESC to go to the starting page
5. Then set zero by double clicking on 0 set(F3)
6. Then go to S function -----> measure-----> rectangular co-ordinate---->station --- >press enter.
7. Here enter the point number or name, instrument height and prism code.

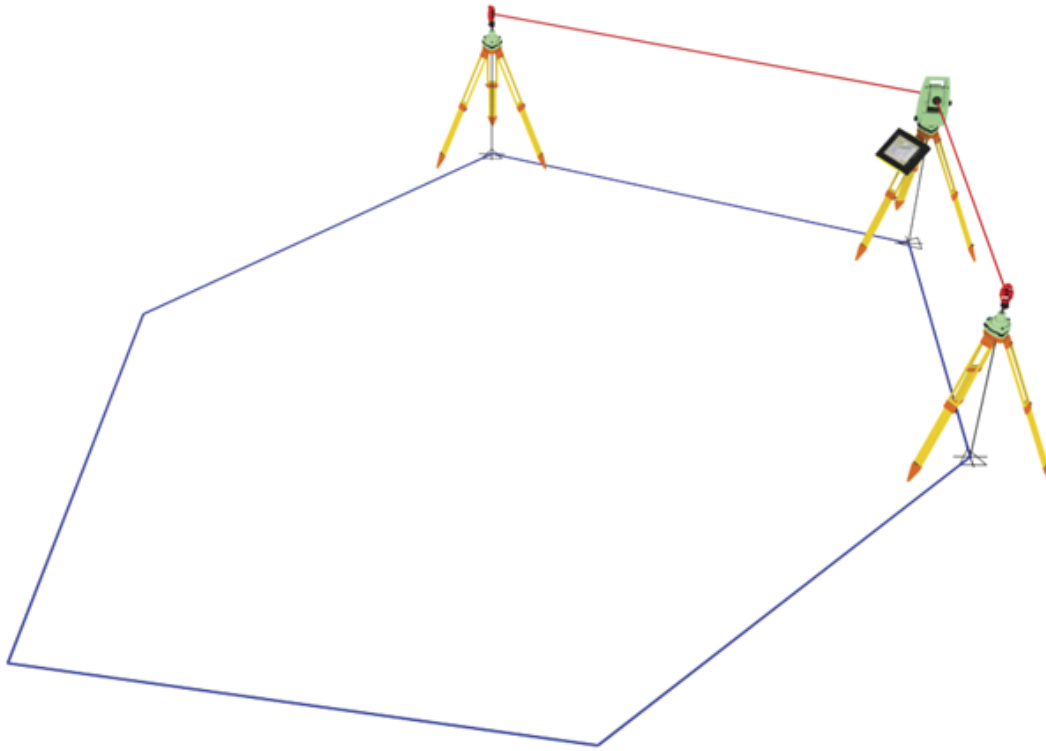


PN .....
E.....
N.....
IH.....
PC.....



8. Then press accept (Fs)
9. Keep the reflecting prism on the first point and turn the total station to the prism ,focus it and bisect it exactly using a horizontal and vertical clamps.
10. Then select MEAS and the display panel will show the point specification
11. Now select edit and re-enter the point number or name point code and enter the prism height that we have set.
12. Then press MEAS/SAVE (F3) so that the measurement to the first point will automatically be saved and the display panel will show the second point.
13. Then turn the total station to second point and do the same procedure.
14. Repeat the steps to the rest of the stations and close the traverse
15. Now go to S function----> view/edit----graphical view.
16. It will show the graphical view of the traverse.

**DIAGRAM:**



---

**1.5 Calculation :**

Select S function---> calculation---> 2D surface----> All-----> accept

**1.6 RESULTS**

Select S function---> calculation---> 2D surface----> All-----> accept

This will give the area of the closed traverse. Area of the closed traverse is calculated.

**1.7 PRE LAB QUESTIONS:**

- 1. What is the temporary adjustment for total station?**
- 2. What is the instrument used for ranging**

**1.8 LAB ASSIGNMENT**

To find the area of a closed traverse using stations by using total station

**1.9 POST LAB QUESTIONS:**

- 1. What Total station operations**
- 2. What is the command we use for horizontal station**

## Experiment No: 9

# HEIGHTS AND DISTANCE USING PRINCIPLES OF TACHEOMETRIC SURVEYING

### 1.1 OBJECTIVE:

To find the heights and distance using principles of Tachometric surveying

### 1.2 RESOURCES:

S.no	Name of the equipment	Rage	type	quantity
1	Theodolite			1
2	Taps			1
3	Arrows			4
4	Ranging rods			4
5	Tripod			1

### 1.3 PERCAUTIONS

- a) Temporary adjustment for Theodolite
- b) Leveling and centering
- c) Focusing adjustment

### 1.4 PROCEDURE

This method is used when the Theodolite is not equipped with a stadia diaphragm. In this method, angular observations are made for two vanes at a fixed vertical distance between them usually 3 m and the horizontal and the vertical distances are computed.

### CASE: 1 WHEN BOTH ANGLES ARE IN ELEVATION

Let  $S$  be the vertical distance between the vanes A and B.  $V$  the vertical distance between instrument axis and lower vane,  $h$  staff reading to lower vane:  $D$  horizontal distance of staff station from instrument,  $\alpha_1$  and  $\alpha_2$  vertical angles to vanes A and B respectively.

Then  $S+V=D \tan \alpha$

$D=S \cos \alpha_1 \cos \alpha_2 / \sin (\alpha_1-\alpha_2)$

$V=D \tan \alpha_2= S \cos \alpha_1 \sin \alpha_2 / \sin (\alpha_1-\alpha_2)$

Elevation of staff station = El. of inst. axis +  $V - h$

### CASE: 2 WHEN BOTH ANGLES ARE IN DEPRESSION

When both angles are of depression:

$V-S= D \tan \alpha_2$

$V=D \tan \alpha_1$

$S=D (\tan \alpha_1-\tan \alpha_2)$

$D= S / \tan \alpha_1-\tan \alpha_2$

$V=d \tan \alpha_1= S \sin \alpha_1 \cos \alpha_2 / \sin (\alpha_1-\alpha_2)$

Elevation of staff station = Height of instrument –  $V - h$

### 1.5 DIAGRAM:

$$V= D \cdot \tan(\text{vertical angle})$$

$$R.L.(B) = R.L.(A) + HI + V - s$$

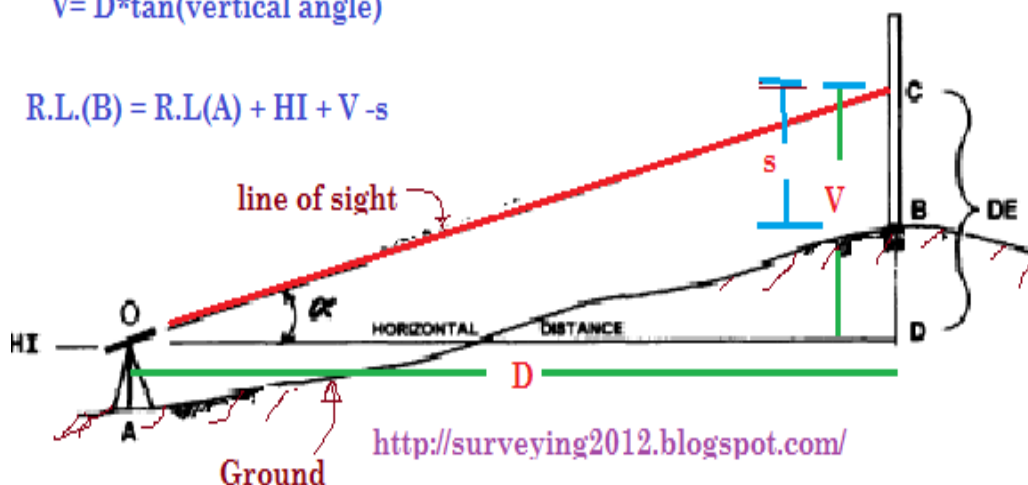


Figure. Trigonometric leveling

**1.6 TABULATION:**

Inst. Station	Height of axis	Staff Stations	Vertical Angle	Hair readings	Remarks

**1.7 RESULTS**

Stadia intercept values top ----- middle ----- bottom-----

**1.8 PRE LAB QUESTIONS:**

1. What is tacheometric leveling?
2. How are the cross hairs in the tacheometric?

**1.9 LAB ASSGNMENT**

- a. Determine the Heights and Distance of a tower Using Principles of Tachometric Surveying.

**1.10 POST LAB QUESTIONS:**

1. What are stadia reading?
2. Explain the procedure?
3. What is stadia intercept?

**Experiment No: 10**  
**CONTOURING USING TOTAL STATION**

**1.1 OBJECTIVE:** Counter plan of given area (One full size drawing sheet) using total station.

**1.2 RESOURCES:**

Sl.No.	Name of the equipment	Rage	Type	Quantity
1	Total station			1
2	Prism			1
3	Tripod			1
4	Pegs			

**1.3 PERCAUTIONS**

- a) **Temporary adjustment for total station**
- b) **Leveling and centering**
- c) **Focusing adjustment**

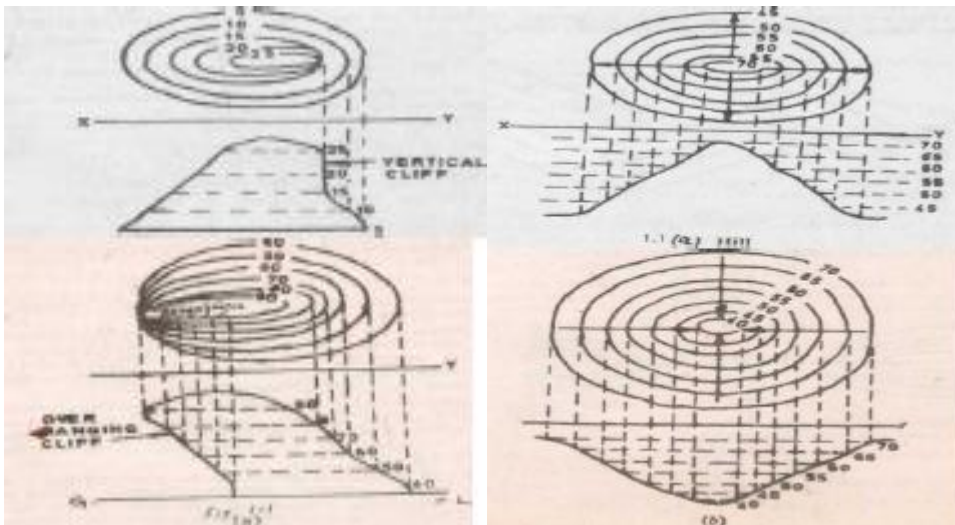
**1.4 PROCEDURE**

The elevation and depression and the undulations of the surface of the ground are shown as map by interaction of level surface with by means of contour line. A contour may be defined as the line of intersection of a level surface with the surface of the ground.

1. Fix the total station over a station and level it
2. Press the power button to switch on the instrument.
3. Select MODE B -----> S function----->file management----->create (enter a name)----->accept
4. Then press ESC to go to the starting page
5. Then set zero by double clicking on 0 set (F3)
6. Then go to S function -----> measure-----> rectangular co-ordinate----->station --- >press enter.
7. Here enter the point number or name, instrument height and prism code.

8. Then press accept (Fs)
9. Adopt Cross section method for establishing the major grid around the study area.
10. Project suitably spaced cross sections on either side of the centre line of the area.
11. Choose several points at reasonable distances on either side.
12. Keep the reflecting prism on the first point and turn the total station to the prism, focus it and bisect it exactly using horizontal and vertical clamps.
13. Then select MEAS and the display panel will show the point specification
14. Now select edit and re-enter the point number or name point code and enter the prism height that we have set.
15. Then press MEAS/SAVE (F3) so that the measurement to the first point will automatically be saved and the display panel will show the second point.
16. Then turn the total station to second point and do the same procedure.
17. Repeat the steps to the rest of the stations and get all point details.
18. Plot cross section lines to scale and enter spot levels.
19. The points on the chosen contours are interpolated assuming uniform slope between adjacent points and join them by a smooth line.

**1.5 DIAGRAM:**





### **1.6 Calculation :**

Select S function---> calculation---> 2D surface----> All-----> accept

### **1.7 RESULTS**

Select S function---> calculation---> 2D surface----> All-----> accept

. The contour of given land is drawn in the sheet.

### **1.8 PRE LAB QUESTIONS:**

- a) What is the Counter Plan?
- b) What is the temporary adjustment for total station?
- c) What is the instrument used for ranging

### **1.9 LAB ASSGNMENT**

Counter plan of given area (One full size drawing sheet) using total station

### **1.10 POST LAB QUESTIONS:**

1. What Total station operations
2. Commends for linear measurement
3. What is the command we use for horizontal station

## Experiment 11

### DETERMINATION OF REMOTE HEIGHT USING TOTAL STATION

#### 1.1 OBJECTIVE:

To find the height of a remote point using total station.

#### 1.2 RESOURCES:

S.no	Name of the equipment	Rage	Type	Quantity
1	total station			1
2	Prism			1
3	Tripod			1
4	Pegs			

#### 1.3 PERCAUTIONS

- a) Temporary adjustment for total station
- b) Leveling and centering
- c) Focusing adjustment

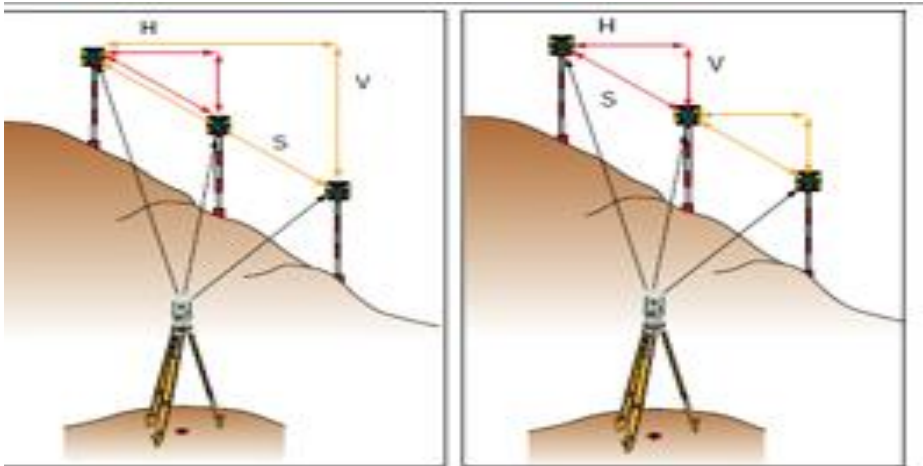
#### 1.4 PROCEDURE

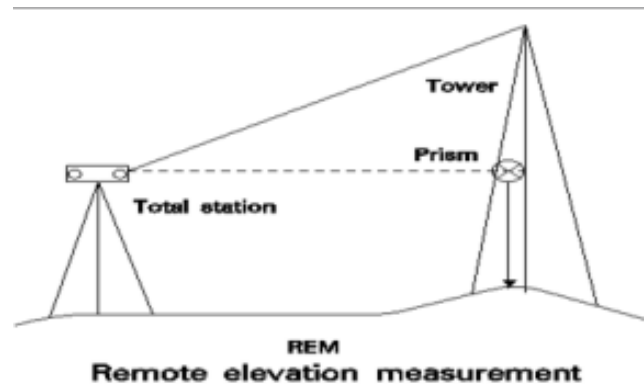
1. Fix the total station over a station and level it
2. Press the power button to switch on the instrument.
3. Select MODE B -----> S function----->file management----->create(enter a name)----->accept
4. Press ESC to go to the starting page
5. Then set zero by double clicking on 0 set(F3)
6. Then go to S function -----> measure-----> rectangular co-ordinate---->station --- >press enter.
7. Here enter the point number or name, instrument height and prism code.

PN .....
E.....
N.....
IH.....
PC.....

8. Then press accept (Fs)
9. Setup a reflector vertically beneath the point, the height of which is to be determined.
10. Enter the reflector height, target to it, and measure the distance.
11. Target the high point.
12. The height difference H between the ground point and the high point is now calculated and displayed at the touch of a button

**1.2 DIAGRAM:**





### 1.3 Calculation :

Select S function---> calculation---> 2D surface----> All-----> accept

### 1.4 RESULTS

Select S function---> calculation---> 2D surface----> All-----> accept

Height of a remote point using total station is obtained

### 1.5 PRE LAB QUESTIONS:

**What is the temporary adjustment for total station?**

**What is the instrument used for ranging?**

**How to find out the Height of the Tower by using Total Station?**

### 1.6 LAB ASSGNMENT

Counter plan of given area (One full size drawing sheet) using total station

### 1.7 POST LAB QUESTIONS:

1. **What Total station operations?**
2. **Commends for linear measurement.**
3. **What is the command we use for vertical station?**

## **Experiment No: 12**

### **STAKE-OUT USING TOTAL STATION**

#### **1.1 OBJECTIVE:**

To find a specific point in the field using Total Station

#### **1.2 RESOURCES:**

S.no	Name of the equipment	Rage	Type	Quantity
1	Total station			1
2	Prism			1
3	Tripod			1
4	Pegs			

#### **1.3 PERCAUTIONS**

- a) **Temporary adjustment for total station**
- b) **Leveling and centering**
- c) **Focusing adjustment**

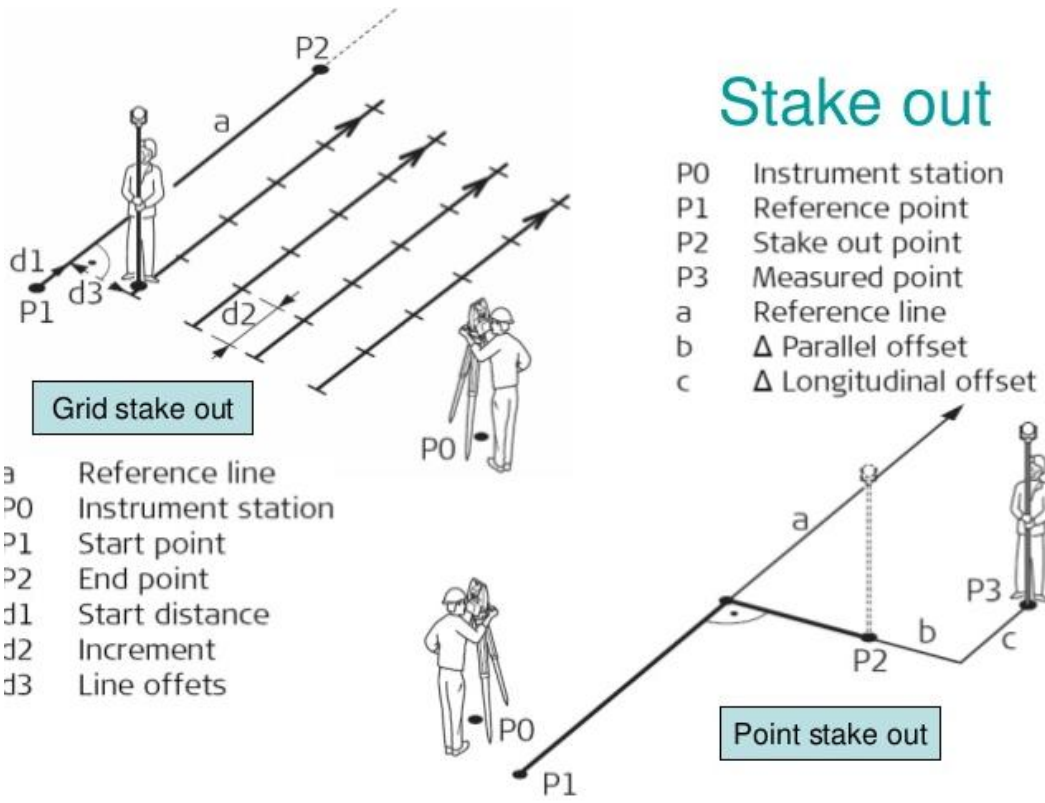
#### **1.4 PROCEDURE**

Place the total station in the spot from which you want to stake out points after you have finished entering the coordinates for the area into the total station's internal memory.

1. Make sure that the total station is level and on secure, even ground before continuing.
2. Press the "Power" button to turn on the instrument.
3. Press the "Menu" button and use the navigation arrows to move down to the "Stake Out" menu option. Press the "Select" button to enter the stake out menu.
4. Select the method to stake out the point. Select "XY" to stake out by coordinates which will be the most common method.

5. Press the "Yes" button to continue the process using the coordinates on the screen.
6. If the coordinates are incorrect, press the "No" button to try again.
7. In the next screen, use the keypad to enter the coordinates or distances and press the "OK" button to measure.
8. The results will be displayed on the following screen.

**DIAGRAM:**



**1.2 Calculation :**

Select Stake function--> calculation--> 2D surface----> All-----> accept

**1.3 RESULTS**

Select Stake function--> calculation--> 2D surface----> All-----> accept

Distance, gradient, diff, height between two inaccessible points using Total Station is calculated.

#### **1.4 PRE LAB QUESTIONS:**

\_\_\_ What do you mean by stake point?

What is the temporary adjustment for total station?

What is the instrument used for ranging

How to find out the Height of the Tower by using Total Station

#### **1.5 LAB ASSIGNMENT**

To find a specific point in the field using Total Station

#### **1.6 POST LAB QUESTIONS:**

1. Total station operations.
2. What is the advantage of stake point?
3. Commands for linear measurement.
4. What is the command we use for vertical station?

## Experiment No: 13

### DISTANCE, GRADIENT, DIFF, HEIGHT BETWEEN TWO INACCESSIBLE POINTS USING TOTAL STATION

#### 1.1 OBJECTIVE:

To find the Distance, gradient, diff, height between two inaccessible points using Total Station.

#### 1.2 RESOURCES:

S.no	Name of the equipment	Rage	Type	Quantity
1	Total station			1
2	Prism			1
3	Tripod			1
4	Pegs			

#### 1.3 PERCAUTIONS

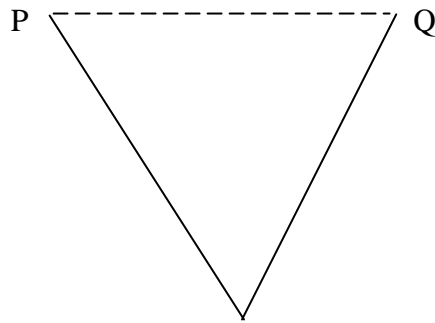
- a) Temporary adjustment for total station
- b) Leveling and centering
- c) Focusing adjustment

#### 1.4 PROCEDURE

1. Fix the total station over a station "O" and level it
2. Press the power button to switch on the instrument.
3. Select MODE B -----> S function----->file management----->create(enter a name)----->accept
4. Press ESC to go to the starting page
5. Then set zero by double clicking on 0 set (F3)
6. Then go to S function -----> measure-----> rectangular co-ordinate---->station --- >press enter.
7. Here enter the point number or name, instrument height and prism code.



8. Select two inaccessible points “P” and “Q” between which the distance, difference in height and gradient is to be measured.
9. Position a reflector pole on point “P” and enter the instrument height  $i$  and the target height  $t_1$  (prism).
10. Target the center of the prism and measure the distance.
11. Rotate the total station towards the other point “Q”, measure the distance between total station and point, measure the horizontal angle between two station points.
12. Enter the target height  $t_2$  (prism) for second point.



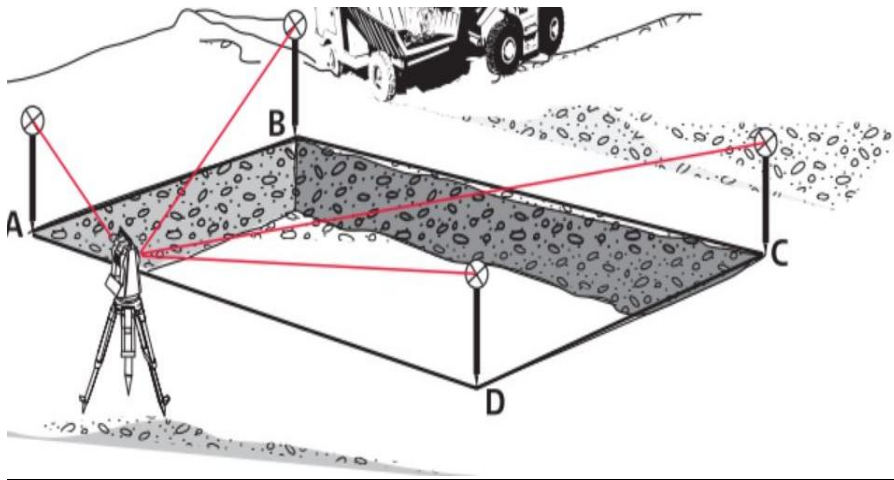
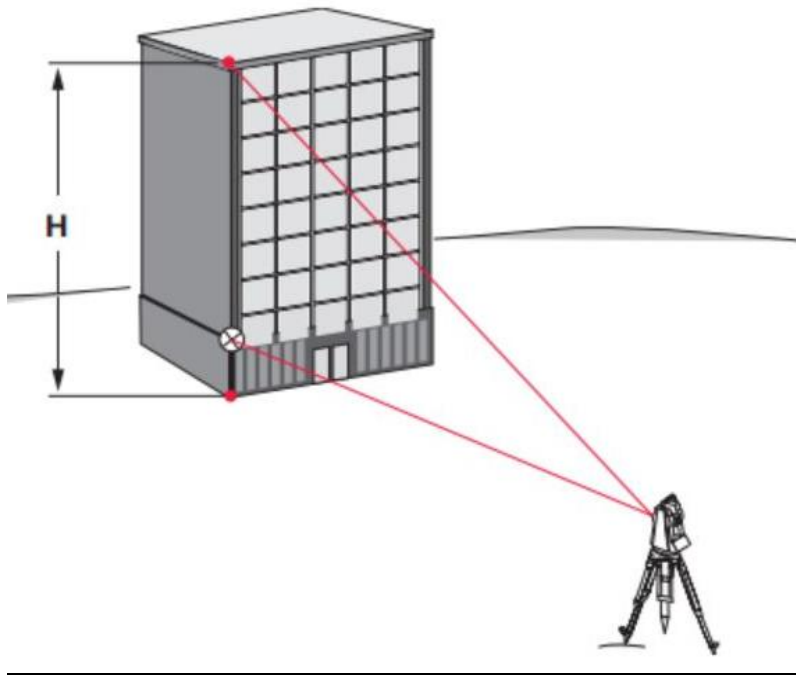
O

Level difference between P and Q

Gradient of line PQ = -----

Horizontal distance PQ

### 1.6 DIAGRAM:



### 1.7 Calculation :

Select S function---> calculation---> 2D surface----> All-----> accept

### 1.8 RESULTS

Select S function---> calculation---> 2D surface----> All-----> accept

Distance, gradient, diff, height between two inaccessible points using Total Station is calculated.

### **1.9 PRE LAB QUESTIONS:**

\_\_\_What is the temporary adjustment for total station?

What is the instrument used for ranging

How to find out the Height of the Tower by using Total Station

### **1.10 LAB ASSIGNMENT**

To find a specific point in the field using Total Station

### **1.7 POST LAB QUESTIONS:**

Distance, gradient, diff, height between two inaccessible points using Total Station is calculated.

1. Total station operations
2. What is the advantage of stake point
3. Commands for linear measurement
4. What is the command we use for vertical station

## **Experiment No: 14**

### **REVISION**

To discuss about the advanced techniques involved in surveying laboratory and their usage in our daily life activities. Measuring of an area, volume, distance, heights, elevations and plotting of contour maps are done easily with the advanced instruments. To make the work fast and safe without any errors in recording the measurement as well as the calculations involved in surveying.