VISION:

To ensure that the Diploma level Technical Education constantly matches the latest requirements of Technology and industry and includes the all-round personal development of students including social concerns and to become globally competitive, technology led organization.

MISSION:

To provide high quality technical and managerial manpower, information and consultancy services to the industry and community to enable the industry and community to face the challenging technological & environmental challenges.

QUALITY POLICY:

We, at MSBTE are committed to offer the best in class academic services to the students and institutes to enhance the delight of industry and society. This will be achieved through continual improvement in management practices adopted in the process of curriculum design, development, implementation, evaluation and monitoring system along with adequate faculty development programmes.

CORE VALUES:

MSBTE believes in the following:

- Skill development in line with industry requirements
- Industry readiness and improved employability of Diploma holders
- Synergistic relationship with industry
- Collective and Cooperative development of all stake holders
- Technological interventions in societal development
- Access to uniform quality technical education.

A Laboratory Manual

For

SURVEYING

(312339)

SEMESER-II

“K-SCHEME”

(AL/CE/CR/CS/LE)

Maharashtra State

Board of Technical Education, Mumbai.

(Autonomous) (ISO: 9001: 2015) (ISO/IEC 27001:2013)

Maharashtra State Board of Technical Education, Mumbai
(Autonomous) (ISO: 9001: 2015) (ISO/IEC 27001:2013)
4th Floor, Government Polytechnic Building, 49, Kherwadi,
Bandra (East), Mumbai – 400051,
(Printed On _____, 2024)

Maharashtra State
Board of Technical Education, Mumbai.

Certificate

This is to certify that Mr. / Ms. ……..

Roll No……of Second semester of Diploma in …….....of Institute,……..…… ……(Code:……)has completed the term work satisfactorily in course **Surveying (312339)** for the academic year 20…… to 20…… as prescribed in the curriculum**.**

Place: ……. Enrollment No: ……..

Date: ……. Exam. Seat No: ……

Subject teacher **Head of the Department** **Principal**

Seal of Institution

PREFACE

The development of the critically important industry-relevant abilities and skills is the main goal of any engineering laboratory or field work in the technical education system. In light of this, MSBTE developed the most recent "K" Scheme curricula for engineering diploma programs, emphasizing outcome-based learning. As a result, a sizable portion of the program is dedicated to practical work. This demonstrates how crucial laboratory work is in helping teachers, instructors, and students understand that every minute of lab time must be used efficiently to create these outcomes rather than wasting it on unnecessary activities. Every practical has thus been created to operate as a "vehicle" to help each student acquire this industry-identified capability in order to ensure the effective implementation of this outcome-based curriculum. The "chalk and duster" practice in the classroom is a challenging way to build practical skills. As a result, the development team of the "K" scheme laboratory manual focused on the intended results when creating the practical, as opposed to the customary approach of performing practical's to "verify the theory".

This lab manual is intended to support all parties involved, particularly the students, instructors, and teachers, in helping the students achieve the pre-established goals. It is required of every student to read through the relevant practical process in its entirety and comprehend the bare minimum of theoretical background related to the practical at least one day in advance of the practical. As a crucial starting point for carrying out the practical, each exercise in this handbook starts with establishing the competency, industry-relevant skills, course outcomes, and practical results. After that, the students will learn about the abilities they will acquire through the process outlined there and the safety measures that must be followed, which will enable them to use in addressing real-world situations in their professional life.

This manual also offers guidance to educators on how to manage resources so that students follow protocols and safety measures methodically and meet learning objectives. This allows teachers and instructors to effectively support student-centered lab activities through each practical exercise.

Today's globalized world has witnessed tremendous technological breakthroughs in surveying equipment and technology. Currently available accurate digital surveying tools are employed because of their speed, precision, and ease of use. The disciplines of civil engineering, mining engineering, environmental engineering, transportation engineering, and marine engineering heavily rely on these tools and applications. Given the importance of remote sensing and Geographic Information Systems (GIS) and their widespread usage in mapping and storing spatial data, it is expected that students will have a basic understanding of these subjects in order to use them in the field. Students who complete this course will have the necessary abilities and competences to perform tasks linked to surveys.

Although best possible care has been taken to check for errors (if any) in this laboratory manual, perfection may elude us as this is the first edition of this manual. Any errors and suggestions for improvement are solicited and highly welcome.

Program outcome (POs)

PO 1. Basic & Discipline specific knowledge: Apply knowledge of basic mathematics, sciences and engineering fundamentals and engineering specialization to solve the engineering problems.

PO 2. Problem Analysis: Identify and analyze well defined engineering problems using codified standard methods.

PO 3. Design /Development Solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

PO 4. Engineering tools experimentation and testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO 5. Engineering practices for society sustainability and environment: Apply appropriate technology in context of society, sustainability, environment and ethical practices.

PO 6. Project Management: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.

PO 7. Lifelong learning: Ability to analyze individual needs and engage in updating in context of technological changes.

List of Relevant Skills

On the successful completion of the course the students will acquire the required industry relevant skills and they will be able to:

1. Use the given surveying instruments.
2. Enter data taken in the field in the required formats.
3. Compute areas and Draw Plans based on the field data.
4. Prepare contour maps.
5. Read and interpret contour maps.
6. Use appropriate method of surveying.

Guidelines to teachers

1. Teacher should provide the guideline with demonstration of practical to the students with all features.
2. Teacher shall explain prior concepts to the students before starting of each practical.
3. Involve students in performance of each practical.
4. Teacher should ensure that the respective skills and competencies are developed in the students after the completion of the practical exercise.
5. Teachers should give opportunity to students for hands on experience after the demonstration.
6. Teacher is expected to share the skills and competencies to be developed in the students.
7. Teacher may provide additional knowledge and skills to the students even though not covered in the manual but are expected the students by the industry.
8. Finally give practical assignment and assess the performance of students based on task assigned to check whether it is as per the instructions.

Instructions to Students

1. Organize the work in the group and make record all programs.
2. Students shall develop maintenance skill as expected by industries.
3. Student shall attempt to develop related hand-on skills and gain confidence.
4. Student shall develop the habits of evolving more ideas, innovations, skills etc. those included in scope of manual
5. Student shall refer technical magazines.
6. Student should develop habit to submit the practical on date and time.
7. Student should well prepare while submitting write-up of exercise.
8. Attach /paste separate papers wherever necessary.

Practical Course outcome matrix:

- CO1 - Suggest relevant type of survey required for the given situation.
- CO2 - Undertake cross staff and compass survey for the given field.
- CO3 - Undertake survey using Theodolite for preparing a plan of the given terrain.
- CO4 - Determine Reduced Level to prepare Contour maps for the given type of terrain.
- CO5 - Prepare the plan using Plane Table Surveying to locate relevant details.

Pr. No.	Title of the Practical	Mapped Course Outcome				
		CO 01	CO 02	CO 03	CO 04	CO 05
01	*Measure the distance between two inter visible survey stations using chain, tape and ranging rods.	--	√	--	--	--
02	*Determine area of open field using chain and cross staff survey.	--	√	--	--	--
03	Determine area of irregular field using Digital Planimeter.	--	√	--	--	--
04	*Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass.	--	√	--	--	--
05	*Measure Fore Bearing and back bearing of a closed traverse of 5 to 6 sides and correct the bearings and included angles.	--	√	--	--	--
06	Measure Horizontal angle by using Transit Theodolite by Direct Method	--	--	√	--	--
07	*Measure Horizontal angle by using Transit Theodolite by method of Repetition.	--	--	√	--	--
08	*Measure vertical angle using Transit Theodolite.	--	--	√	--	--
09	*Project 01:-Use transit theodolite to carry out Survey Project for closed traverse for minimum 5 sides (Compulsory).	--	√	√	--	--
10	*Determine Reduced Level by Height of Instrument Method.	--	--	--	√	--
11	*Determine Reduced Level by Rise and Fall Method.	--	--	--	√	--
12	*Perform Fly Levelling to check levelling work.	--	--	--	√	--
13	*Project 02:-Profile leveling and cross-sectioning for a road length of 300 m with cross-section at 20 m interval. (Compulsory).	--	--	--	√	--
14	Undertake differential leveling by using dumpy level/Auto Level and leveling staff for Installation of irrigation pipelines.	--	--	--	√	--
15	Prepare Contour Plan/map using Block Contouring for the area of 40m x 40m to draw its contour plan.	--	--	--	√	--

16	*Project 03:-Plotting contour map using block contouring method for a block of 150m x 150m with grid of 10m x 10m for given land parcel. (Compulsory).	--	--	--	√	--
17	Prepare Contour plan for control farming using block contouring method.	--	--	--	√	--
18	*Prepare plans and locate details by using Radiation Method.	--	--	--	--	√
19	*Prepare plans and locate details by Intersection Method.	--	--	--	--	√
20	*Prepare traverse using Transit Theodolite.	--	--	--	--	√
21	Prepare plan to establish plant nursery.	--	--	--	--	√

CONTENT PAGE

List of Practical's and Formative Assessment sheet.

Pr. No	Title of the Practical	Page No.	Date of perfor mance	Date of Submis sion	Assess ment marks	Dated sign of teacher	Remarks (if any)
01	*Measure the distance between two inter visible survey stations using chain, tape and ranging rods.	01					
02	*Determine area of open field using chain and cross staff survey.	06					
03	Determine area of irregular field using Digital Planimeter.	11					
04	*Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass.	15					
05	*Measure Fore Bearing and back bearing of a closed traverse of 5 to 6 sides and correct the bearings and included angles.	20					
06	Measure Horizontal angle by using Transit Theodolite by Direct Method.	24					
07	*Measure Horizontal angle by using Transit Theodolite by method of Repetition.	30					
08	*Measure vertical angle using Transit Theodolite.	36					
09	*Project 01:-Use transit theodolite to carry out Survey Project for closed traverse for minimum 5 sides (Compulsory).	--					
10	*Determine Reduced Level by Height of Instrument Method.	42					
11	*Determine Reduced Level by Rise and Fall Method.	46					
12	*Perform Fly Levelling to check levelling work.	50					
13	*Project 02:-Profile leveling and cross-sectioning for a road length of 300 m with cross-section at 20 m interval. (Compulsory).	--					

Pr. No	Title of the Practical	Page No.	Date of perfor mance	Date of Submis sion	Assess ment marks	Dated sign of teacher	Remarks (if any)
14	Undertake differential leveling by using dumpy level/Auto Level and leveling staff for Installation of irrigation pipelines.	55					
15	Prepare Contour Plan/map using Block Contouring for the area of 40m x 40m to draw its contour plan.	60					
16	*Project 03:-Plotting contour map using block contouring method for a block of 150m x 150m with grid of 10m x 10m for given land parcel. (Compulsory).	--					
17	Prepare Contour plan for control farming using block contouring method.	65					
18	*Prepare plans and locate details by using Radiation Method.	70					
19	*Prepare plans and locate details by Intersection Method.	74					
20	*Prepare traverse using Transit Theodolite.	78					
21	Prepare plan to establish plant nursery.	82					
Total marks :							

These marks are to be transferred in pro-forma published by MSBTE.

- '*' Marked Practical (LLOs) are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

Practical No: 01 **Measure the distance between two inter visible survey stations using chain, tape and ranging rods.**

I. Practical Significance:

Measurement of length of line between two inter visible survey stations on flat ground for the planning or construction of any civil engineering projects.

II. Industry/Employer expected outcome(s):

- Marking the straight line on ground by using the eye observations and line ranger.
- Accurate measurement of length of line by using the tape or chain.

III. Course Level Learning Outcome (COs):

- CO 2- Undertake cross staff and compass survey for the given field.

IV. Laboratory Learning Outcome (LLO):

- LLO 1.1 - Find the distance between two given inter-visible points.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Direct ranging is done when the two end stations of the survey lines are inter visible. When these two survey stations are inter visible ranging can either done by eye observation or by any other optical instrument like line ranger etc. Ranging is the process of marking the straight line between two survey stations by fixing the intermediate ranging rods.

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Metric Chain	20m/30m	2 nos.
02	Metallic or PVC tape	15m/20m/30m	2 nos.
03	Ranging rods	2m length	5 nos.
04	Pegs	Wooden/Steel	2 nos
05	Arrows	GI wired	4 nos
06	Line ranger	As per IS specification	2 nos.

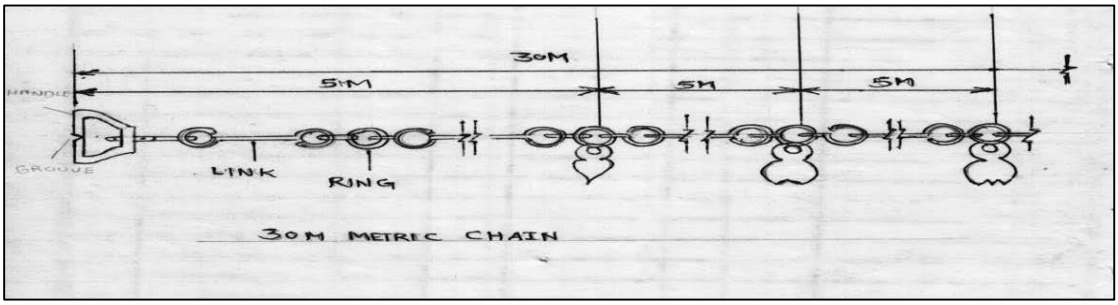
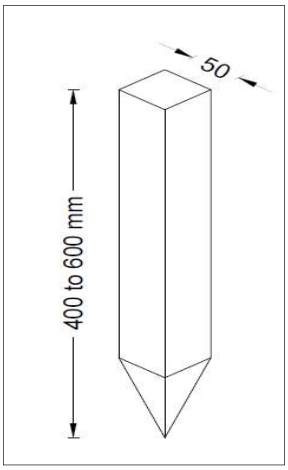
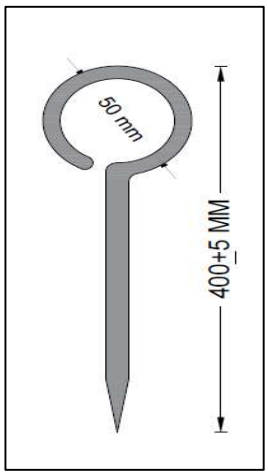


Figure 1.1 Metric Chain

Figure 1.2 Metallic tape and line ranger





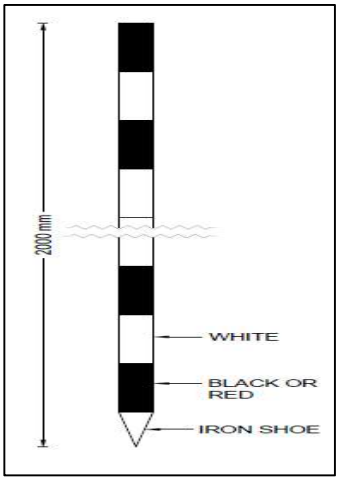


Figure 1.3 Wooden Peg **Figure 1.4 Arrow** **Figure 1.5 Ranging Rods**

VIII. Precautions to be followed:

1. Calibrate the chain with standard gauge before starting the survey work.
2. Ranging should be done precisely.
3. Pegs, arrows, ranging rods should be fixed truly vertical on ground.
4. Ensure that there are no knots in chain or tape while measuring the distance.

IX. Procedure:

1. First collect the all instruments as per mentioned in point no VII from the survey lab.
2. Let, A and B the two points at the ends of a survey line.
3. First erect the ranging rod on point B while the surveyor stands with another ranging rod at point A.

4. The other assistant's will go and hold the ranging rod approximately on line AB.
5. The surveyor at A the signals the assistant's to move transverse to the chain line, till that assistant is in line with point A and B.
6. By using this procedure the further more line can range by the surveyor.
7. After the ranging of line measure the distance accurately.
8. After this collect all the instruments and return to the lab.
9. Draw the drawing of line with accurate measurements and with scale.

X. Observation Drawing:

XI. Result:

XII. Interpretation of results:

XIII. Conclusions:

- Horizontal distance between AB is = _____m.

XIV. Practical Related Questions:

1. Explain the procedure of calibration of chain?
2. Distinguish between Direct and indirect ranging.

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 02 **Determine area of open field using chain and cross staff survey.**

I. Practical Significance:

The area of open filed can be determined by using chain and cross staff survey where main survey line is the longest line of survey work and the offset are made perpendicular to that line. This is the most suitable method of area calculation for an open field.

II. Industry/Employer expected outcome(s):

- Calculating the area of open field by using chain and cross staff.

III. Course Level Learning Outcome (COs):

- CO 2- Undertake cross staff and compass survey for the given field.

IV. Laboratory Learning Outcome (LLO):

- LLO 2.1 Undertake chain and cross staff survey for the given plot.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Chain and cross staff survey is used to locate the boundaries of a field and to determine its area. A chain line is running through the center of the area which divides the area into a number of triangles and trapezoids. The offsets to the boundary are taken in order of their chainages.

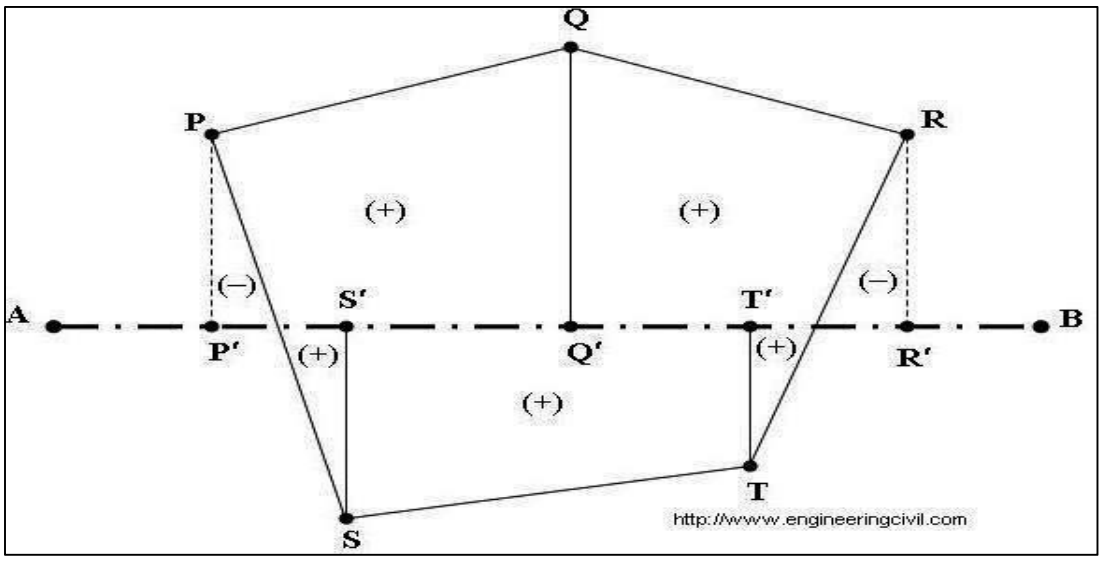


Figure 2.1: Chain and cross staff survey.

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Metric Chain	20m/30m	2 nos.
02	Metallic or PVC tape	15m/20m/30m	1 nos.
03	Ranging rods	2m length	10 nos.
04	Pegs	Wooden	2 nos
05	Arrows	GI wired	2 nos
06	Open cross staff/optical square	As per IS specification	2 nos
07	Line ranger	As per IS specification	2 nos.

VIII. Precautions to be followed:

1. Main/Base line should run through the center of field and should cover complete field.
2. Offset to base line should be truly perpendicular.
3. Avoid long offset.

IX. Procedure:

1. First collect the all instruments as per mentioned in point no VII from the survey lab.
2. Let, A and B are the two points in the field through which the base line is passing.
3. Do the ranging for the line AB by using direct method of ranging.
4. After ranging of line AB lay the chain over line AB.
5. After that select the approximate points of offset and fix the arrow there.
6. Take the open cross staff place on the line AB on predefined point of offset.
7. The one observer will bisect the ranging rod of any one of the end station and another observer will bisect the ranging rod fixed on end of offset.
8. Accurate and simultaneous observation of both the observer will set the perpendicular offset to main survey line.
9. Then measure the distance of offset on base line and also measure the distance of offset line.
10. Set more offset to the main line and note down the observations and measurements.
11. Record and draw all the accurate observation in field book.

X. Observation Drawing:

Sr. No.	Figure	Chainage (m)		Base line (m)	Offset (m)		Mean offset (m)	Area (in m^2)		Remarks
		From	To		First	Second		(+ve)	(-ve)	
Total Area (sq. m)										
Net Area (sq. m)										

XI. Results:

Total Area of the field=_____ Sq. m

XII. Interpretation of results:

XIII. Conclusions:

XIV. Practical Related Questions:

1. Distinguish between offset setting by open cross staff and line ranger.
2. Explain types of offset.

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			**Dated sign of Teacher**
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 03 **Determine area of irregular field using Digital Planimeter.**

I. Practical Significance:

It is easy to calculate the area of field with regular or definite shape with the help of formulae but in case of irregular shape it becomes tedious to calculate the area. Digital planimeter is the device which is used to calculate the area of irregular figures. For example in case of topographical maps where areas are having irregular shape, those areas can easily get calculated by digital planimeter.

II. Industry/Employer expected outcome(s):

- Determining the area of plan of any shape.

III. Course Level Learning Outcome (COs):

- CO 2 - Undertake cross staff and compass survey for the given field.

IV. Laboratory Learning Outcome (LLO):

- LLO 3.1 Calculate area of irregular plot from given plan of plot.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

A planimeter is an instrument which measures the area of plan of any shape very accurately. Before introducing digital planimeter there are two types of planimeter first Amsler Polar and second Roller planimeter. The mathematical calculation were needed to perform with polar and amsler planimeter to determine area but in digital planimeter no need to perform mathematical calculation as the area is directly get calculated by planimeter itself.

Figure 3.1 Digital Planimeter.

VII. Required Resources:

Sr. No.	Resource required	Particulars	Quantity
01	Digital planimeter.	As per IS standards.	1 nos.
02	Map or Figure with irregular Shape.	As per requirement	1 nos

VIII. Precautions to be followed:

1. Read the operating manual of instrument before use.
2. Tracing point is moved precisely over the boundary of figure or plan.
3. Set the scale as per the given drawing to the planimeter.

IX. Procedure:

1. First collect the digital planimeter and map from the lab.
2. Fix the map or drawing firmly on table.
3. Understand the use every keys provided on control panel of planimeter.
4. Select the appropriate scale on digital planimeter as per requirement.
5. Mark the starting point of plan.
6. Press the start button and start tracing operation of plan.
7. Press hold and memory key after completion of tracing operation to display the lengths nad area of traced plan with their prior set units.
8. Repeat the same procedure twice and average of the reading will give the accurate area of plan.
9. Switch the instrument of off and return it to lab.

X Results:

- Average area of the plan/topo sheet etc. =_____Sq. unit

XI. Interpretation of results:

XII. Conclusions:

XIII. Practical Related Questions:

1. What is the principle of planimeter?
2. How accurate the digital planimeter?

Space for Answer

XIV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 04 **Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass.**

I. Practical Significance:

Chain and cross staff surveying can be used for small and fairly flat areas but in case of large area it become essential to use some sort of instruments which helps to observe the angles and directions of lines. These horizontal angles can be observed by using prismatic compass.

II. Industry/Employer expected outcome(s):

- Determine the angle of survey line on ground.

III. Course Level Learning Outcome (COs):

- CO 2- Undertake cross staff and compass survey for the given field.

IV. Laboratory Learning Outcome (LLO):

- LLO 4.1 Determine bearing using Prismatic Compass.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Bearing of line is the horizontal angle made by the line with reference to the north direction. Bearing observed in the progress of survey work and in the opposite of survey work are known as fore bearing and back bearing respectively. The fore and back bearing of line shows the difference of $\pm$ 180 degree when it is free from the nearby presence of magnetic substances. The instrument which is used to measure the bearing is known as prismatic compass.

VII. Required resources/equipment.

Sr. No.	Resource required	Particulars	Quantity
01	Prismatic compass with stand	As per IS standard	1 nos
02	Metric chain	30m	1 nos.
03	Metallic tape	30m	1 nos
04	Ranging rods	2m length	5 nos
05	Pegs	Wooden	1 nos
06	Arrows	GI wired	4 nos

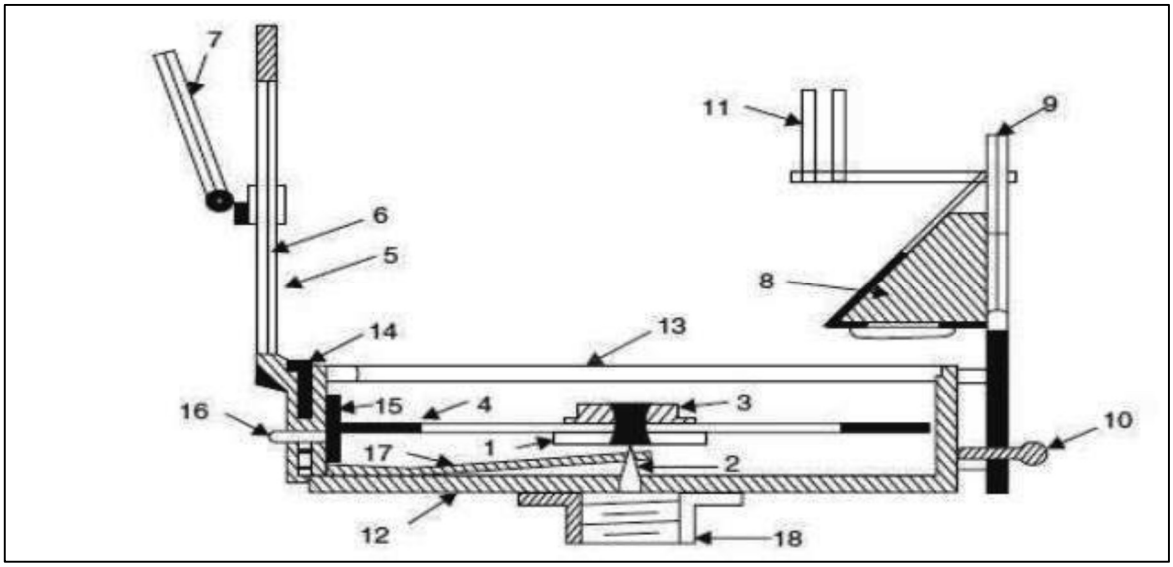


Figure 4.1 Prismatic Compass

Part No.	Description	Part No.	Description
01	Needle	**10**	Focusing stud for prism
02	Pivot	**11**	Hinged Sun Glasses
03	Agate Cap	**12**	Compass box
04	Compass ring	**13**	Glass cover
05	Object Vane	**14**	Lifting pin
06	Horse Hair	**15**	Spring break
07	Adjustable mirror	**16**	Break Pin
08	Prism	**17**	Lifting arm
09	Eye Vane	**18**	Ball and socket joint.

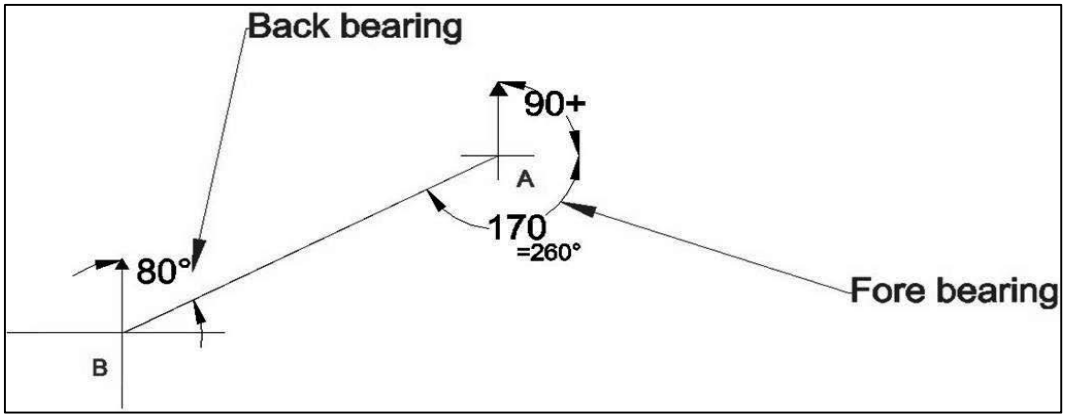


Figure 4.2 Fore Bearing & Back Bearing:

VIII. Precautions to be followed:

1. Fix the prismatic compass exactly over the station.
2. Temporary adjustment of the prismatic compass should be done precisely.
3. The graduated aluminum ring should float freely.
4. Bearing should observe and record carefully.

IX. Procedure:

1. First collect the all instruments as per mentioned in point no VIII from the survey lab.
2. Fix the prismatic compass over Station A.
3. The following steps of temporary adjustment of prismatic should follow before observing the baring of line AB.

   Centering: It is the process of keeping the instrument exactly over the station. For this drop the small piece of stone from the underneath of compass so that it will fall exactly over the peg fixed on the station point.

   Levelling: It is the process of keeping the compass in level by using the ball and socket arrangement provided at the top of tripod stand. When graduated aluminum ring is started to swing freely the instrument is said to be levelled.

   Adjustment of prism: It is the process of focusing the prism by moving up and down of its vertical run to ensure that readings are clearly visible.
4. Fix the ranging rod at station B.
5. Turn the prismatic compass until the ranging rod of station B is get bisected by the horse hair of object vane.
6. After that when needle and graduated ring stop the oscillation observe the bearing of line which is fore bearing of line AB and note the same accurately.
7. Then shift the compass over station B repeat the procedure followed over station A and observe the bearing of line AB which is back bearing of line AB.
8. Record the reading accurately.
9. Return back the instrument to survey store.

X. Observation Table:

Sr. No.	Station	Line	Length (m)	Fore Bearing	Back Bearing	Difference (FB-BB)=+180

XI. Results:

- Fore Bearing and Back Bearing of line_____respectively are _____&_____.
- Line___ is having exact 180 degree.

XII. Interpretation of results:

XIII. Conclusions:

XIV. Practical Related Questions:

1. Why don't we observe the FB & BB with respect to South?
2. Explain error in compass survey.

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 05 **Measure fore bearing and back bearing of a closed traverse of 5 to 6 sides and correct the bearings and included angles.**

I. Practical Significance:

When the fore and back bearing of line does not have the exact difference of ±180 degree it means the prismatic compass is affected by local attraction. Local attraction is the condition arises due to the presence of magnetic field around the compass, due to which the magnetic needle gets deflected from its original position.

II. Industry/Employer expected outcome(s):

- Determining the magnetic bearing of line
- Plotting of open and closed traverse on field.
- Determining and providing correction to the stations affected by local attraction.

III. Course Level Learning Outcome (COs):

- CO 2- Undertake cross staff and compass survey for the given field.

IV. Laboratory Learning Outcome (LLO):

- LLO 5.1 Prepare traverse using Prismatic Compass.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Traversing is that type of survey in which a number if connected survey lines from the directions and lengths of survey line are measured with the help of prismatic compass and chains respectively. When the lines from a closed loop which ends at the starting point is known as closed traverse. If the loop of lines or series of line ends other than the starting point is known as open traverse.

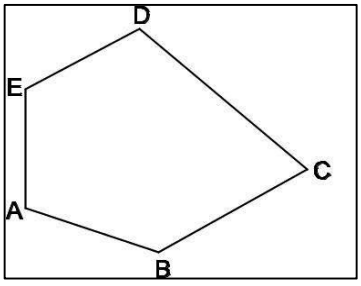


Figure 5.1 Closed traverse

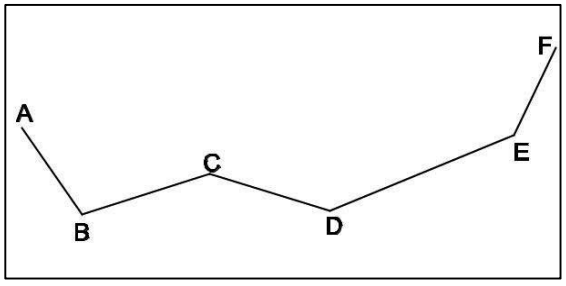


Figure 5.2 Open traverse

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Metric chain	30m	1 nos.
02	Metallic tape	30m	1 nos
03	Ranging rods	2m length	5 nos
04	Pegs	Wooden	1 nos
05	Arrows	GI wired	4 nos
06	Prismatic compass with stand	As per IS standard	1 nos

VIII. Precautions to be followed:

1. Pegs should fix exact over the station in truly vertical manner.
2. Temporary adjustment of the prismatic compass should be done properly.
3. The graduated aluminum ring should suspend freely.
4. Bearing should observe and record carefully.

IX. Procedure:

1. First collect the all instruments as per mentioned in point no VIII from the survey lab.
2. Do the detailed inspection of field and fix the position of stations of closed traverse.
3. Fix the position of stations of traverse A, B, C, D, and E.
4. Measure the distance of line AB, BC, CD, DE, EA.
5. Set the prismatic compass over Station A.
6. Observe the FB and BB of line AB and EA respectively from station A.
7. Set the prismatic compass over Station B.
8. Observe the FB and BB of line BA and AB respectively from station B.
9. After this shift the prismatic compass over the consecutive station C, D, and E.
10. Repeat the procedure and record the FB of forward line and BB of preceding line from each station of traverse and record it accurately in field book.
11. Calculate the included angles from the observed bearings.
12. Apply the check for included angle i.e. sum of included angle should be = (2n-4) x 90°.
13. If condition satisfied then ok or else repeat the procedure on every station.
14. Return back the instrument to survey store.

X. Observation Table:

Sr. No.	Station	Line	Length (m)	Fore Bearing	Back Bearing	Difference (FB-BB)=±180

XI. Results:

XII. Interpretation of results:

XIII. Conclusions:

XIV. Practical Related Questions:

1. Explain local Attraction.
2. How to provide correction's to the included angle?

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 06 Measure Horizontal angle by using Transit Theodolite by Direct Method.

I. Practical Significance:

Plotting open traverse on the field by using the horizontal angles and lengths of lines. Theodolite is the instrument which is helpful to measure the angles with high precision.

II. Industry/Employer Expected Outcome(s):

- Determining the horizontal angle of any survey line.
- Plotting the plans/maps on the ground.

III. Course Level Learning Outcome (COs):

- CO3 - Undertake survey using Theodolite for preparing a plan of the given terrain.

IV. Laboratory Learning Outcome (LLO):

- LLO 6.1:- Use transit theodolite to measure Horizontal angle by Direct Method.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Theodolite is the most accurate instrument used for measurement of horizontal and vertical angles. Theodolite is mainly used to lay off horizontal angles, locating the points on lines, prolonging survey lines, determining the differences in elevation of any points in earth surface. There are two types of theodolite i) Transit and ii) Non-transit theodolite. To minimize the error in observation of angles the average reading of face left and face right position of theodolite is considered.

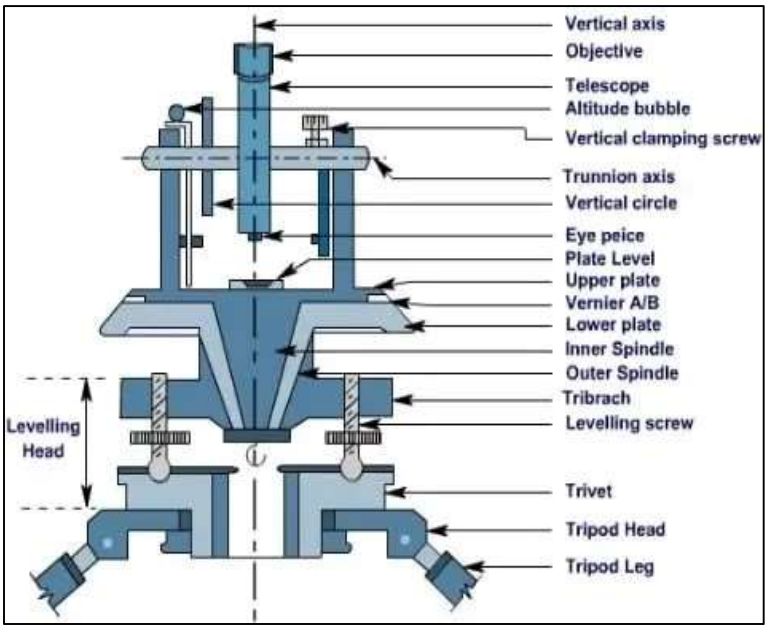


Figure 6.1 Transit theodolite.

VII. Required Resources:

Sr. No.	Resource required	Particulars	Quantity
01	Transit theodolite	As per IS Standard	1 nos.
02	Tripod stand	As per IS Standard	1 nos
03	Peg	Wooden	3 nos
04	Ranging rods	2m length	2 nos
05	Measuring Tape	30 m	1 nos.

VIII. Precautions to be followed:

1. Precise Temporary adjustment of the theodolite.
2. Bisect the ranging rod of station point accurately.
3. Read the Vernier's accurately.
4. Record the reading properly.

IX. Procedure:

1. First collect the all instruments as per mentioned in point no VII from the survey lab.
2. Set the theodolite over the station point Q and do the temporary adjustment of theodolite.
3. Remove the parallax by properly focusing the object glass.
1. Set the horizontal circle of Vernier A at 00° 00'00'' and Vernier B at 180° 00' 00'' by using upper tangent screw and fix the upper clamp.
4. After this keep the lower clamp loose and bisect the ranging rod of station P and fix the upper and lower clamp both.
5. With face left position of theodolite unclamp the upper screw only and rotate the theodolite to bisect the ranging rod of station R.
6. Clamp the upper lower screw and record the reading of Vernier A and B.
7. Now the angle recorded on Vernier A and B will give the angle PQR.
8. Repeat the same procedure with face right also.
9. The average of face left and face right will give the accurate angle.
10. Return back the instrument to survey store.

X. Observation Table:

Sr. No	Station	Object	Face	Readings on Verniers						Mean of Verniers			Angle			Mean Angle			Remark
				A			B												
				°	I	II	°	I	II	°	I	II	°	I	II	°	I	II	

Sr. No	Station	Object	Face	Readings on Verniers						Mean of Verniers			Angle			Mean Angle			Remark
				A			B												
				°	I	II	°	I	II	°	I	II	°	I	II	°	I	II	

XI. Result:

XII. Interpretation of Results:

XIII. Conclusions:

XIV. Practical Related Questions:

1. State the function of upper and lower clamp screw.
2. What is the significance of face left and face right observation?

Space for Answer

XV. Assessment Scheme:

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 07 **Measure Horizontal angle by using Transit Theodolite by Method of Repetition.**

I. Practical Significance:

Plotting open traverse on the field by using the horizontal angles and lengths of lines. Method of repetition is the method which provides the accuracy in measurement of angles.

II. Industry/Employer Expected Outcome(s):

- Determining the horizontal angle with accuracy.
- Plotting the plans/maps on the ground.

III. Course Level Learning Outcome (COs):

- CO3:- Undertake survey using Theodolite for preparing a plan of the given terrain.

IV. Laboratory Learning Outcome (LLO):

- LLO 7.1:- Use transit theodolite to measure Horizontal angle by method of Repetition.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Traversing can be done with the use of theodolite. With face left and face right position of theodolite, error can be minimized in angle measurement. The method of repetition is the method where error in angle measurement can reduced at high level. Theodolite is the instrument which enables surveyor to measure the least horizontal angle with high precision.

VII. Required Resources:

Sr. No.	Resource required	Particulars	Quantity
01	Transit theodolite with tripod stand	As per IS Standard	1 nos.
02	Peg	Wooden	3 nos
03	Ranging rods	2m length	2 nos
04	Measuring Tape	30 m	1 nos.
05	Hammer	As per specification	1 nos.

VIII. Precautions to be followed:

1. Precise Temporary adjustment of the theodolite.
2. Bisect the ranging rod of station point accurately.
3. Read the Vernier's accurately.
4. Record the reading properly.

IX. Procedure:

1. First collect the all instruments as per mentioned in point no VII from the survey lab.
2. Set the theodolite over the station point Q and do the temporary adjustment of theodolite.

3. Remove the parallax by properly focusing the object glass.
4. Set the horizontal circle of Vernier A at 00° 00’00’’ and Vernier B at 180° 00’ 00’’ by using upper tangent screw and fix the upper clamp.
5. After this keep the lower clamp loose and bisect the ranging rod of station P and fix the upper and lower clamp both.
6. With face left position of theodolite unclamp the upper screw only and rotate the theodolite to bisect the ranging rod of station R.
7. Clamp the upper lower screw and record the reading of Vernier A and B.
8. Now unclamp the lower screw only and rotate the theodolite and again bisect the ranging rod of station P and clamp the lower screw.
9. Now unclamp the upper screw and rotate theodolite to bisect the ranging rod of station R and then clamp upper screw and record the reading of Vernier A and Vernier B.
10. Repeat the procedure again for third time with same face left only.
11. Again do the same procedure of repetition with face right.
12. Average reading of face left and face right will give the accurate reading of angle PQR.
13. Return back the instrument to survey store.

X. Observation Table:

Sr. No	Station	Object	Face	Readings on Verniers						Mean of Verniers			Angle			Mean Angle			Remark
				A			B												
				°	I	II	°	I	II	°	I	II	°	I	II	°	I	II	

Sr. No	Station	Object	Face	Readings on Verniers						Mean of Verniers			Angle			Mean Angle			Remark
				A			B												
				°	I	II	°	I	II	°	I	II	°	I	II	°	I	II	

XI. Result:

XII. Interpretation of Results:

XIII. Conclusions:

XIV. Practical Related Questions:

1. Explain the face left and face right position of transit theodolite.
2. Why the observations are made through face right and face left position?

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 08 Measure vertical angle using Transit Theodolite.

I. Practical Significance:

Theodolite is the precision instrument for measuring the vertical angle in the vertical planes. Generally, vertical angles are required to measure when the vertical heights or elevation are needed to determine.

II. Industry/Employer Expected Outcome(s):

- Measurement of vertical angle with accuracy.

III. Course Level Learning Outcome (COs):

- CO3 - Undertake survey using Theodolite for preparing a plan of the given terrain.

IV. Laboratory Learning Outcome (LLO):

- LLO 8.1:- Use transit theodolite to measure Vertical angle.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Generally, the vertical angles with theodolite are needed to determine in case of tachometry. The vertical height of the ground or reduced level of hilly area can be easily get determined with the help of vertical angle measurements. Theodolite is the instrument which enable the surveyor to measure the angle with accuracy.

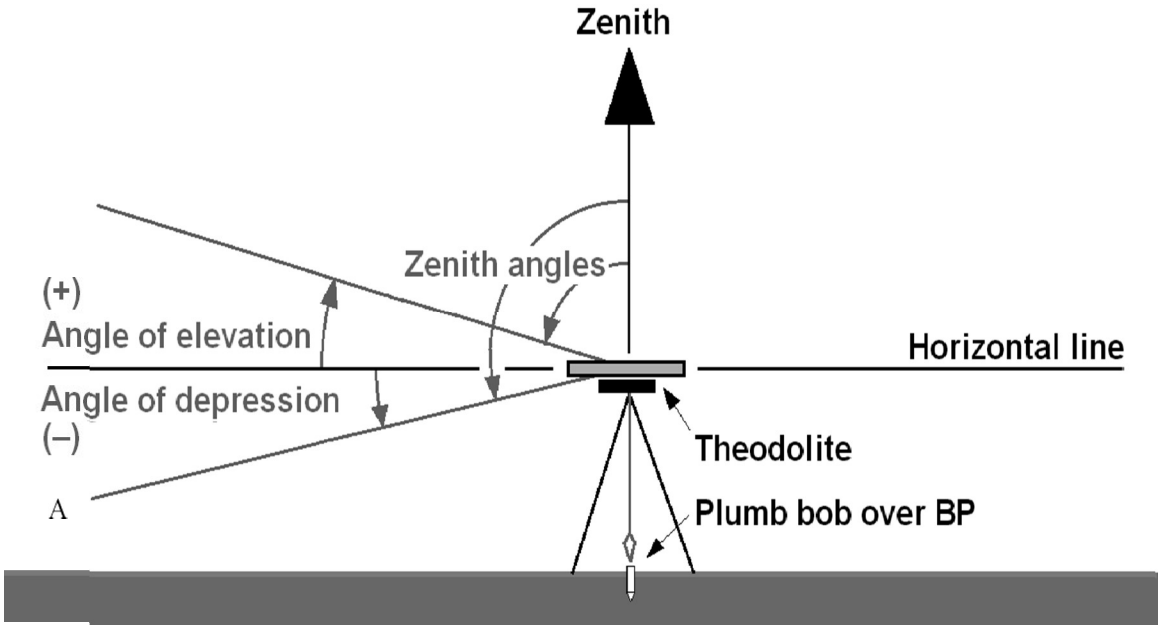


Figure 8.1 Vertical Angle measurements with theodolite.

VII. Required Resources:

Sr. No.	Resource required	Particulars	Quantity
01	Transit theodolite with tripod stand	As per IS Standard	1 nos.
02	Peg	Wooden	3 nos
03	Ranging rods	2m length	2 nos
04	Measuring Tape	30 m	1 nos.
05	Hammer	As per specification	1 nos.

VIII. Precautions to be followed:

1. Precise Temporary adjustment of the theodolite.
2. Bisect the ranging rod of station point accurately.
3. Read the Vernier's accurately.
4. Record the reading properly.

IX. Procedure:

1. First collect the all instruments as per mentioned in point no VIII from the survey lab.
2. Set the theodolite over the given station and fix the theodolite over it. Perform temporary adjustment of instrument.
3. Set the vertical circle Vernier C at 00° 00'00'' and Vernier D at 00° 00' 00'' and use the vertical tangent screw for smaller adjustments.
4. Unclamp the vertical clamp and bisect A approximately, clamp vertical clamp. Using Vertical clamp and vertical tangent screw.
5. Unclamp the vertical clamp and bisect the object A approximately, clamp vertical clamp. Using vertical tangent screw bisect the object A precisely.
6. Take the readings at the Vernier C and D and that is the vertical angle.
7. Unclamp vertical clamping screw, transit the telescope bisect the object i.e. B approximately, clamp vertical clamp. Using vertical tangent screw bisect B precisely. Take the reading at the Vernier C and D and get the angle of elevation.
8. Repeat the same procedure with face right.
9. The average reading of face left and face right will give the accurate vertical angle.
10. Return back the instrument to survey store.

X. Observation Table:

Sr. No	Station	Object	Face	Readings on Verniers						Mean of Verniers			Angle			Mean Angle			Remark
				C			D												
				°	I	II	°	I	II	°	I	II	°	I	II	°	I	II	

Sr. No	Station	Object	Face	Readings on Verniers						Mean of Verniers			Angle			Mean Angle			Remark
				C			D												
				°	I	II	°	I	II	°	I	II	°	I	II	°	I	II	

XI. Result:

XII. Interpretation of Results:

XIII. Conclusions:

XIV. Practical Related Questions:

1. Explain the function of vertical clamp screw and vertical tangent screw.
2. What is angle of depression and angle of elevation?

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 10 Determine Reduced Level by Height of Instrument Method.

I. Practical Significance:

If reduced levels of different points are known then it is very easy to know the nature or type of ground. Planning of different construction activities is possible by considering nature of ground. Economical constructions are possible from knowledge of reduced levels. Reduced levels can be calculated by using Height of Instrument method in simple levelling, differential levelling, check levelling, fly levelling, etc. Dumpy level/Auto level is used to measure the elevations of different stations of the surface of the earth. Difference in elevations between different points can also be determined using Levels.

II. Industry/Employer expected outcome(s):

- Calculation of Reduced Levels.

III. Course Level Learning Outcome (COs):

- CO 4- Determine Reduced Level to prepare Contour maps for the given type of terrain.

IV. Laboratory Learning Outcome (LLO):

- LLO 10.1 Undertake differential leveling by Height of instrument method using dumpy level/Auto Level and leveling staff.

V. Relevant Affective Domain related Outcome(s):

- Follow safe practices.
- Practice good housekeeping.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

The Height of Instrument method is a technique used in surveying to determine the difference in elevations between two points .It is commonly used in design & construction to create site plans. In height of instrument method height of plane of collimation is calculated by taking back sight on point of known elevation i.e. Datum. Then from HI staff readings taken on Intermediate station points & last station points are reduced to calculate the reduced levels of points. Levelling is the process of measuring vertical distances with respect to given datum. This method is a simple and rapid method of reduction of levels.

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Dumpy/Auto level with tripod stand	As per standard Specification	1 nos.
02	Levelling staff	4m	1 nos.
03	Field book for recording readings	As per standard norms of field book page	1 nos.

VIII. Precautions to be followed:

1. Perform temporary adjustments precisely.
2. Hold the staff truly vertical.
3. Read staff reading accurately.
4. Record the reading accurately in the level book.

IX. Procedure:

1. First collect the all instruments as per mentioned in point no VII from the survey lab.
2. Mark the staff stations on the ground whose elevations are to be found.
3. Set up the level approximately midway between the stations and perform temporary adjustments.
4. Swing the telescope towards the staves and observe and record the staff readings in the appropriate columns of the level book.
5. Find the elevations of the points by HI method.
6. Return the instruments to survey store.
7. Record field book page.

X. Observation Table:

Inst. Station	Staff Reading			Height of Instrument	Reduced Level	Remark
	BS	IS	FS			

XI. Result:

1. Elevation of A=
2. Elevation of B=

XII. Interpretation of results:

XIII. Conclusions:

XIV. Practical Related Questions:

1. State the situation where HI method is adopted.
2. Write arithmetic check used in HI method.

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 11 **Determine Reduced Level by Rise and Fall Method.**

I. Practical Significance:

If reduced levels of different points are known then it is very easy to know the nature or type of ground. Planning of different construction activities is possible by considering nature of ground. Economical constructions are possible from knowledge of reduced levels. Reduced levels can be calculated by using Rise & Fall method in simple levelling, differential levelling, check levelling, fly levelling, etc.

II. Industry/Employer Expected Outcome(s):

- Calculation of Reduced Levels.

III. Course Level Learning Outcome (COs):

- CO4 - Determine Reduced Level to prepare Contour maps for the given type of terrain.

IV. Laboratory Learning Outcome (LLO):

- LLO 11.1 Undertake differential leveling by Rise and fall method using dumpy level/Auto Level and leveling staff.

V. Relevant Affective Domain related Outcome(s):

- Follow safe practices.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

The Rise & Fall method is a technique used in surveying to determine the difference in elevations between two points .It is commonly used in design & construction to create site plans. In rise & fall method two simultaneous reading are compared. If second reading is lesser than first then difference is entered in rise & if second reading is greater than first then difference in readings is entered in fall. Levelling is the process of measuring vertical distances with respect to given datum. In this method complete check on every reading.

VII. Required Resources:

Sr. No.	Resource required	Particulars	Quantity
01	Dumpy/Auto level with tripod stand	As per IS Standard	1 nos.
02	Levelling staff	4m	2 nos
03	Field book for recording readings	As per standard norms of field book page	1 nos

VIII. Precautions to be followed:

1. Perform temporary adjustments precisely.
2. Hold the staff truly vertical.
3. Read staff reading accurately.
4. Record the reading accurately in the level book.

IX. Procedure:

1. First collect the all instruments as per mentioned in point no VII from the survey lab.
2. Mark the staff stations on the ground whose elevations are to be found.
3. Set up the level approximately midway between the stations and perform temporary adjustments.
4. Swing the telescope towards the staves and observe and record the staff readings in the appropriate columns of the level book.
5. Find the elevations of the points by rise and fall method.
6. Return back the instrument to survey store.
7. Record field book page.

X. Observation Table:

Inst. Station	Staff Reading			Rise	Fall	Reduced Level	Remark
	BS	IS	FS				

XI. Result:

1. Elevation of A=
2. Elevation of B=

XII. Interpretation of Results:

XIII. Conclusions:

XIV. Practical Related Questions:

1. State the situation where Rise & Fall method is adopted.
2. Write arithmetic check used in Rise & Fall method

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 12 **Perform Fly Levelling to check levelling work.**

I. Practical Significance:

Dumpy level/Auto level is used to find reduced levels of unknown points from known datum. During survey work always it is not possible to complete the work from single datum. Hence in medium to large project works establishment of temporary bench marks becomes necessary to continue the work on next day. Fly levelling is a type of levelling which is used simply to establish such temporary bench marks. After completion of any work either minor, medium of major project work verification of calculated reduced levels must be verified. Hence by check levelling survey work is done in reverse direction & reduced level of first datum is verified

II. Industry/Employer Expected Outcome(s):

- Establishment of temporary bench marks by using dumpy level/ Auto level and levelling staff.

III. Course Level Learning Outcome (COs):

- CO4 - Determine Reduced Level to prepare Contour maps for the given type of terrain.

IV. Laboratory Learning Outcome (LLO):

- LLO 12.1 Undertake fly leveling with double check using dumpy level/ Auto level and leveling staff.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

When survey work is large then temporary bench marks are set up by using fly levelling and when days' work or project work is finished it is to be checked by check levelling. In fly & check levelling only back sights & fore sights are taken. It involves no of change points. Temporary adjustments are necessary at each & every setup of instrument.

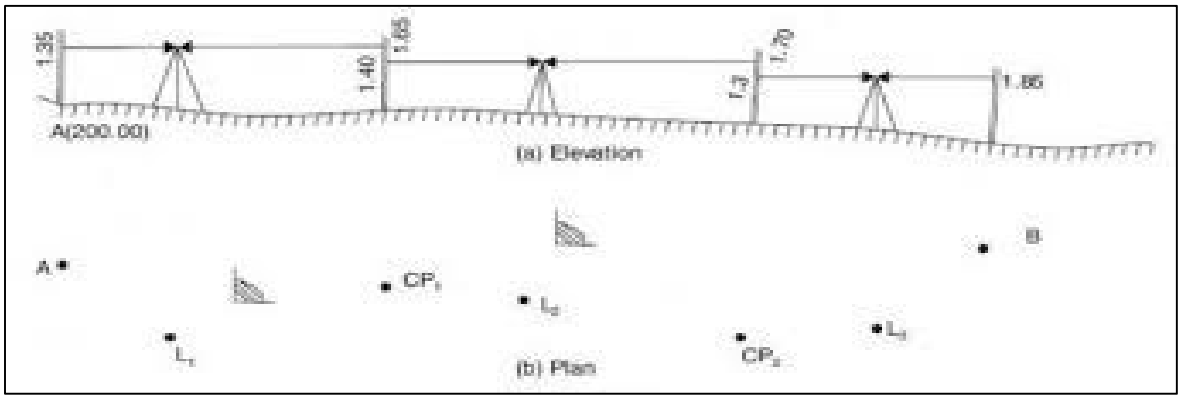


Figure 12.1 Fly Levelling/ Check levelling

VII. Required Resources:

Sr. No.	Resource required	Particulars	Quantity
01	Dumpy/Auto level with tripod stand	As per standard Specification	1 nos.
02	Levelling staff	4m	2 nos
03	Field book for recording readings	As per standard norms of field book page	1 nos

VIII. Precautions to be followed:

1. Perform temporary adjustments precisely.
2. Hold the staff truly vertical.
3. Read staff reading accurately.
4. Enter the staff readings correctly in the level book.

IX. Procedure:

1. First collect the all instruments as per mentioned in point no VII from the survey lab.
2. Mark the staff stations on the ground whose elevations are to be found.
3. Position of the level should be approximately midway between the BS and FS stations
4. Rotate the telescope towards the levelling staff on BM, observe and record the staff readings in the BS columns of the level book.
5. Take a FS on the point towards working site. This point, would be change point (CP).
6. Shift the instrument to new position. First reading from the new instrument position is the BS on change point.
7. Continue the procedure till the readings on the suitable station at working site is recorded.
8. Find the elevations of the points by HI or rise and fall method.
9. Return back the instrument to survey store.

X. Observation Table:

Inst. Station	Staff Reading		Rise	Fall	Reduced Level	Remark
	BS	FS				

Inst. Station	Staff Reading		Rise	Fall	Reduced Level	Remark
	BS	FS				
SUM=						

Arithmetic Check:

XI. Result:

- RL of TBM 1=
- RL of TBM 2 =
- RL of TBM 3 =
- RL of TBM 4 =
- RL of TBM 5 =
- RL of TBM n (last) =
- RL of Starting BM =

XII. Interpretation of Results:

XIII. Conclusions:

XIV. Practical Related Questions:

1. State the purpose of fly levelling.
2. State the situation where fly levelling is done

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			**Dated sign of Teacher**
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 14 **Undertake differential levelling by using dumpy level/Auto Level and levelling staff for Installation of irrigation pipelines.**

I. Practical Significance:

On the site field situations are different. Depending the object survey method of levelling is selected. When two points whose difference in elevation is to find these points may be located at great distance or difference in level is more. Differential levelling is adopted by using Dumpy level or Auto level.

II. Industry/Employer Expected Outcome(s):

- Selection of appropriate method of levelling for installation of irrigation pipelines.

III. Course Level Learning Outcome (COs):

- CO4 - Determine Reduced Level to prepare Contour maps for the given type of terrain.

IV. Laboratory Learning Outcome (LLO):

- LLO 14.1- Undertake differential levelling operation for agriculture land.

V. Relevant Affective Domain related Outcome(s):

- Demonstrate working as a leader/a team member.
- Practice good housekeeping.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

This method is used in order to find the difference in elevation between two points. (i) If they are too far apart, or (ii) if the difference in elevation between them is too great, or (iii) if there are obstacles intervening in such a case, it is necessary to set up the level in several positions and to work in a series of stages. The method of simple levelling is employed in each of the successive stages. The process is also known as compound of continuous levelling

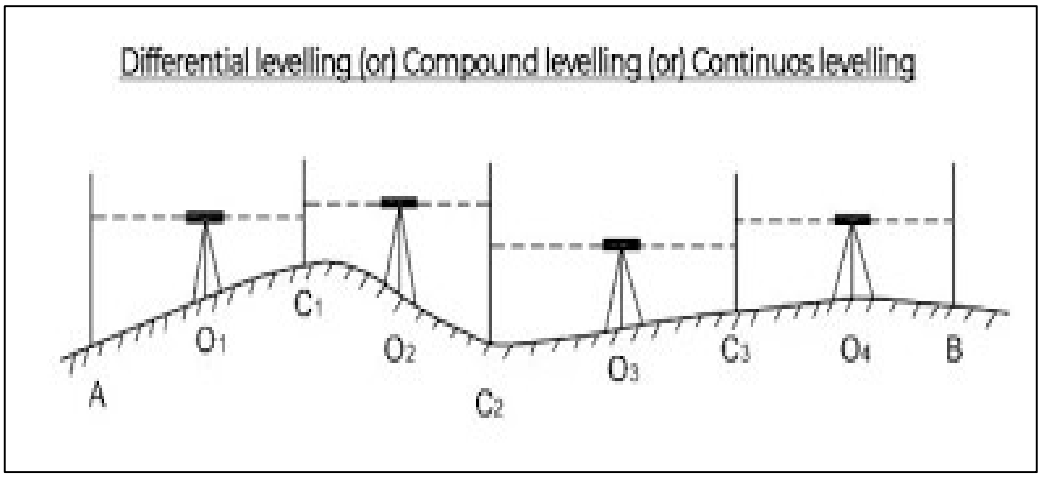


Figure 14.1 differential levelling

VII. Required Resources:

Sr. No.	Resource required	Particulars	Quantity
01	Dumpy/Auto level with tripod stand	As per standard Specification	1 nos.
02	Levelling staff	4m	2 nos
03	Field book for recording readings	As per standard norms of field book page	1 nos

VIII. Precautions to be followed:

1. Perform temporary adjustments precisely.
2. Hold the staff truly vertical.
3. Read staff reading accurately.
4. Enter the staff readings correctly in the level book.

IX. Procedure:

1. First collect the all instruments as per mentioned in point no VII from the survey lab.
2. Mark the staff stations on the ground whose elevations are to be found.
3. Set up the level at a point from where BM is visible and perform temporary adjustments
4. Swing the telescope towards the staves and observe and record the staff readings in the appropriate columns of the level book.
5. Shift the instrument to new position when it is not possible to take readings from that position. Last reading from the earlier station will be FS and first reading from the new instrument position is the BS.
6. Continue the procedure till the readings on the last station is recorded.
7. Find the elevations of the points by **HI** or rise and fall method.
8. Return back the instrument to survey store.
9. Rule out a page of filed book.

X. Observation Table:

Inst. Station	Staff Reading			HI Method or		Reduced Level	Remark
	BS	IS	FS	Rise	Fall		

Inst. Station	Staff Reading			HI Method or		Reduced Level	Remark
	BS	IS	FS	Rise	Fall		
SUM =							

Arithmetic Check:

XI. Result:

XII. Interpretation of Results:

XIII. Conclusions:

XIV. Practical Related Questions:

1. Explain the function of vertical clamp screw and vertical tangent screw.
2. What is angle of depression and angle of elevation?

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 15 **Prepare Contour Plan/map using Block Contouring for the area of 40m x 40m to draw its contour plan.**

I. Practical Significance:

Contour maps are used to understand the topography of the site, locate watershed line, and determine reservoir capacity, inter-visibility between the two stations. Knowing the topography engineering projects can be planned accordingly & executed.

II. Industry/Employer expected outcome(s):

- Drawing contours & preparation of Contour map.

III. Course Level Learning Outcome (COs):

- CO 4 -Determine Reduced Level to prepare Contour maps for the given type of terrain.

IV. Laboratory Learning Outcome (LLO):

- LLO 15.1 Conduct block contouring for the area of 40m x 40m to draw its contour plan.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Contour maps are drawn to know the topography of the site from which different civil engineering projects can be planned. Procedure of locating a contour between two given points by linear interpolation is a prerequisite. Knowing the characteristics of contours is also essential. Contour is a line joining the points of equal elevations. Contour interval is the vertical difference between two successive contours. By observing contour map it is very easy to find depressions, hills or other topographical features within the area.

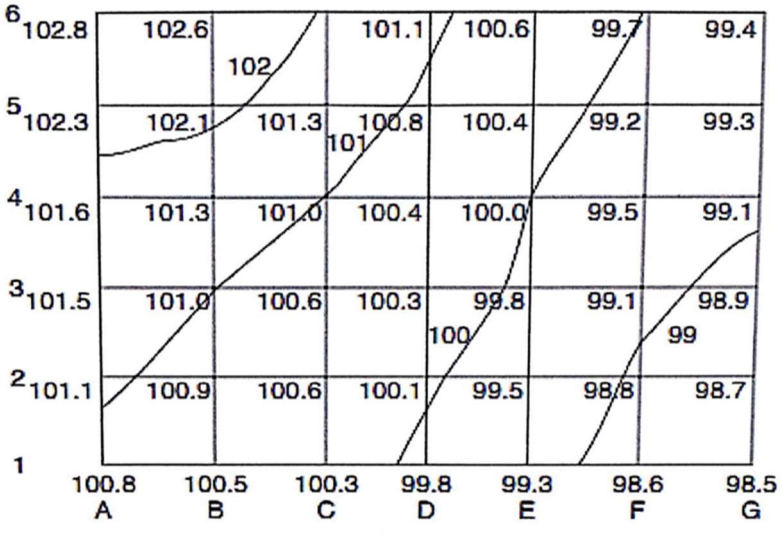


Figure no 15.1 Block Contouring

VII. Required Resources:

Sr. No.	Resource required	Particulars	Quantity
01	Dumpy/Auto level with tripod stand	As per IS standards.	01No
02	Levelling staff.	As 4m	02 No
03	Field book for recording readings	As per standard page of field book	01 No
04	Chain/Tape	30m	02 No
05	Ranging Rods	2m	08 No
06	Open Cross staff with stand	As per standard specification	02 No

VIII. Precautions to be followed:

1. Lay down the grid accurately using Chain/tape and cross staff.
2. Measure the bearing of the centre line accurately.
3. Perform temporary adjustment of level precisely.
4. Hold the staff truly vertical
5. Read & record staff reading accurately.

IX. Procedure:

1. Collect the required instruments as per table in point VII from survey store.
2. Lay down the grid of 5m x 5m size in the block of 40 m x 40 m.
3. Mark the staff stations on the ground whose elevations are to be found.
4. Set up the level and perform temporary adjustments.
5. Establish the BM by fly levelling.
6. Start the levelling process from the BM established in Sr.No.5.
7. Swing the telescope towards the staves and observe and record the staff readings in the appropriate columns of the level book.
8. Shift the instrument to new position when it is not possible to take readings from that position. For that select a change point (CP). Last reading from the earlier station will be FS then shift the instrument. First reading from the new instrument position shall be on the change point & mark as BS.
9. Continue the procedure till the readings on the last station is recorded.
10. Find the elevations of the points by HI or rise and fall method.
11. Return the instruments to survey store.

X. Observation Table:

Inst. Station	Staff Reading			HI Method or		Reduced Level	Remark
	BS	IS	FS	Rise	Fall		

Inst. Station	Staff Reading			HI Method or		Reduced Level	Remark
	BS	IS	FS	Rise	Fall		
SUM =							

Arithmetic Check:-

XI. Results:

1. RLs of all nodal points of the grid are calculated and shown on the grid.
2. Contours at required interval are drawn using linear interpolation.

XII. Interpretation of results:

XIII. Conclusions:

XIV. Practical Related Questions:

1. State the situations where block contouring is adopted.
2. Suggest suitable method to draw contour map of a hill.
3. State the practical situations where two contours crosses each other.

Space for Answer

XV. Assessment Scheme.

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 17 **Prepare Contour plan for control farming using block contouring method.**

I. Practical Significance:

Contour maps are used to understand the topography of the site, locate watershed line, and determine reservoir capacity, inter-visibility between the two stations. Knowing the topography engineering projects can be planned accordingly & executed. Contour farming reduce soil erosion by as much as 50-60 percent compared with vertical ploughing. It also helps to reduce sediment runoff and increase water infiltration.

II. Industry/Employer expected outcome(s):

- Preparation of contour map for agricultural purpose.

III. Course Level Learning Outcome (COs):

- CO4 - Determine Reduced Level to prepare Contour maps for the given type of terrain.

IV. Laboratory Learning Outcome (LLO):

- LLO 17.1 plotting contour map using block contouring method for 10 Are Agriculture land.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Contour maps are drawn to know the topography of the site from which different civil engineering projects can be planned. Procedure of locating a contour between two given points by linear interpolation is a prerequisite. Knowing the characteristics of contours is also essential contour farming is the practice of tillage, planting, and other farming operations performed on or near the contour of the field slope. This method is most effective on slopes between two (2) and ten (10) percent.

Figure no 17.1 Contour Farming

VII. Required Resources:

Sr. No.	Resource required	Particulars	Quantity
01	Dumpy/Auto level with tripod stand	As per IS standards.	01No
02	Levelling staff.	As 4m	02 No
03	Field book for recording readings	As per standard page of field book	01 No
04	Chain/Tape	30m	02 No
05	Ranging Rods	2m	08 No
06	Open Cross staff with stand	As per standard specification	02 No

VIII. Precautions to be followed:

1. Perform temporary adjustments precisely.
2. Hold the staff truly vertical.
3. Read staff reading accurately.
4. Enter the staff readings correctly in the level book

IX. Procedure:

1. Collect the required instruments as per table in point VII from survey store.
2. Lay down the grid of 10m x 10m size in the block of 200 m x 200 m.
3. Mark the staff stations on the ground whose elevations are to be found.
4. Set up the level and perform temporary adjustments.
5. Establish the BM by fly levelling.
6. Start the levelling process from the BM established in Sr.No.5.
7. Swing the telescope towards the staves and observe and record the staff readings in the appropriate columns of the level book
8. Shift the instrument to new position when it is not possible to take readings from that position. For that select a change point (CP). Last reading from the earlier station will be FS then shift the instrument. First reading from the new instrument position shall be on the change point & mark as BS.
9. Continue the procedure till the readings on the last station is recorded.
10. Find the elevations of the points by HI or rise and fall method.
11. Return the instruments to survey store.

X. Observation Table:

Inst. Station	Staff Reading			Height of instrument	Reduced Level	Remark
	B.S.	I.S.	F.S.			

Inst. Station	Staff Reading			Height of instrument	Reduced Level	Remark
	B.S.	I.S.	F.S.			

XI. Results:

1. RLs of all nodal points of the grid are calculated and shown on the grid.
2. Contours at required interval are drawn using linear interpolation.

XII. Interpretation of results:

XIII. Conclusions:

XIV. Practical Related Questions:

1. Give Practical situation when two contours crosses each other's.
2 State the different methods of interpolation of contours.

Space for Answer

XV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 18 **Prepare plans and locate details by using Radiation Method.**

I. Practical Significance:

At some situations decisions are required to be taken quickly. Accuracy is always not important but decisions are necessary. In such situations plane table survey is important. If area to be surveyed is plane & can be commanded from a single station then radiation method is very significant .In plane table surveying plotting of the plan and field observations can be done simultaneously. As drawing is completed in the site itself, Plane table survey is popularly used for small survey works.

II. Industry/Employer expected outcome(s):

- Prepare plan by plane table survey with present field situation.

III. Course Level Learning Outcome (COs):

- CO 5- Prepare the plan using Plane Table Surveying to locate relevant details.

IV. Laboratory Learning Outcome (LLO):

- LLO 18.1 Use plane table survey to prepare plan and locate details by using Radiation Method.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Principle of plane table survey-Principle of plane tabling is parallelism, means "all the rays drawn through various details should pass through survey station".Information of accessories of plane table with their use .Suitability of method of plane tabling as prevailing fields situation.

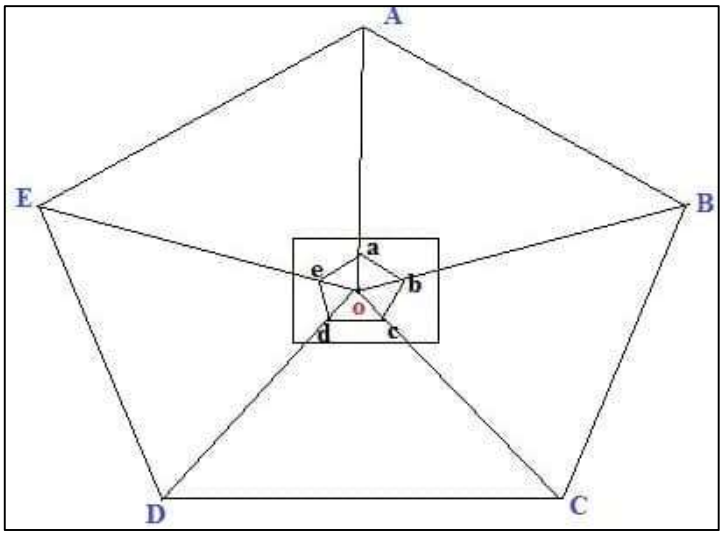


Figure No. 18.1 Radiation method of Plane Table Survey

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Plane table	Well-seasoned, good quality drawing board made of pine or teak wood having smooth, plane finish on its top and fitted with ball and socket arrangement or a levelling head, varying in size from 75cmX60cmXl .5cm or 60cmX50cmXl.5cm or 50cmX40cmX1.5cm	1 nos.
02	Plane/ telescopic Alidade	A plane alidade metallic (brass or gunmetal) or good quality wooden rule with a fine beveled edge. A telescopic alidade consists of a telescope which provides a very accurate line of sight. The telescope is fitted onto an A- frame which is fitted onto a heavy rule	1 nos.
03	Spirit level	Tubular level, which can be placed into perpendicular position	2 nos.
04	Trough compass	Usually it is 15cm long and provided with magnetic needle to facilated orientation of the plane table and to mark north direction	1nos
05	U-frame or Plumbing fork	It is a hairpin-shaped brass frame having two arms of equal length one end of frame is pointed, the end of the frame carries a plumb-bob	1 nos
06	Drawing Sheet	Good quality drawing sheet, tinted off white	1 nos
07	Clamps	Clamps of suitable size	4 nos.

VIII. Precautions to be followed:

1. Set the instrument exactly over the station on ground
2. Perform temporary adjustment accurately.
3. Alidade should be properly placed while bisecting the objects
4. Measure the distances on the ground correctly
5. Take suitable scale for plotting
6. Perform survey during dry weather

IX. Procedure:

1. Select the station point P in such a way that from P all points should be visible.
2. Set up the plane table over the station P and perform temporary adjustment, 1.e., levelling, orientation and cantering of the table and transfer the point P over the drawing sheet and also mark the north direction at top right comer.
3. With alidade touching station P, bisect the ranging rod A and draw ray on drawing sheet. Measure the distance PA on ground and to a suitable scale mark the position of A on drawing sheet i.e., 'a'.
4. Repeat the above procedure and mark the station b, c, d and e
5. Join point a, b, c, d, e and an on drawing sheet you will get required five sided closed traverse.

X. Results:

- Polygon plotted drawing sheet.

XI. Interpretation of results:

XII. Conclusions:

XIII. Practical Related Questions:

1. How two different positions of plane table are linked with one another? State in brief.
2. State the limitations of Radiation method.
3. What are the likely errors in Radiation method and precaution to be taken to eliminate them?

Space for Answer

XIV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			**Dated sign of Teacher**
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 19 **Prepare plans and locate details using Intersection Method.**

I. Practical Significance:

When the survey work is to be completed within available time & field situations are very difficult for chaining then this method of plane table is significant. When chaining is difficult, intersection method of plane tabling is significant. The knowledge of locating inaccessible points/stations is necessary. The plane table surveying is the fast method of surveying. In plane table surveying plotting of the plan and field observations can be done simultaneously. When chaining work has to reduce then intersection method of plane tabling is used.

II. Industry/Employer expected outcome(s):

- Prepare plan by plane table survey with present field situation.

III. Course Level Learning Outcome (COs):

- CO 5- Prepare the plan using Plane Table Surveying to locate relevant details.

IV. Laboratory Learning Outcome (LLO):

- LLO 19.1 Use plane table survey to prepare plan and locate details by using Intersection Method.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Parallelism is the principle of plane table survey. Information of all the accessories of plane table with their use is necessary. Similarly different methods of plane tabling with their suitability under different field situation must be known. Intersection method is generally adopted to locate inaccessible points/stations, horizontal distance between the points on different banks of river, points separated by deep valleys, etc. are to be determined.

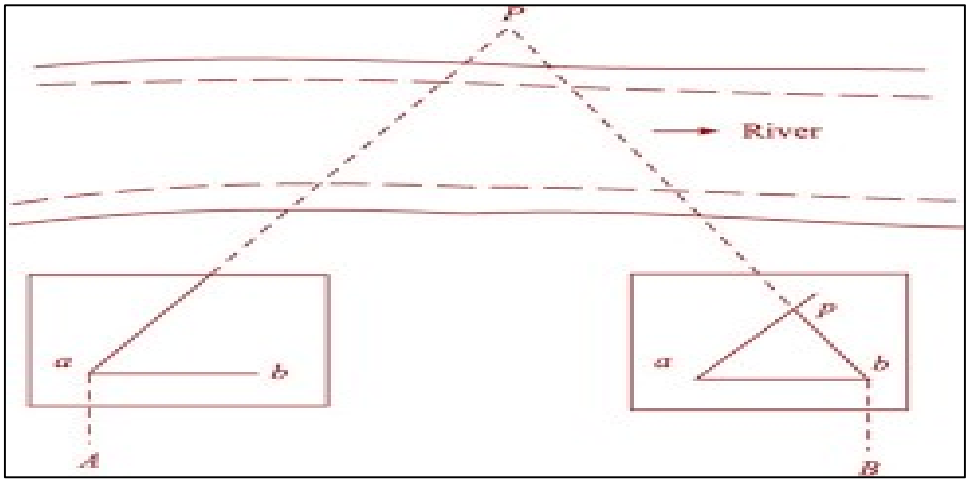


Figure No. 19.1 Intersection method of Plane Table Survey

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Plane table	Well-seasoned, good quality drawing board made of pine or teak wood having smooth, plane finish on its top and fitted with ball and socket arrangement or a levelling head, varying in size from 75cm X 60cmX l .5cm or 60cm X 50cm X l.5cm or 50cmX40cmX1.5cm.	1 nos.
02	Plane/ telescopic Alidade	A plane alidade metallic (brass or gunmetal) or good quality wooden rule with a fine beveled edge.A telescopic alidade consists of a telescope which provides a very accurate line of sight. The telescope is fitted onto an A- frame which is fitted onto a heavy rule.	1 nos.
03	Spirit level	Tubular level, which can be placed into perpendicular position.	2 nos.
04	Trough compass	Usually it is 15cm long and provided with magnetic needle to facilated orientation of the plane table and to mark north direction	1nos
05	U-frame or Plumbing fork	It is a hairpin-shaped brass frame having two arms of equal length one end of frame is pointed, the end of the frame carries a plumb-bob.	1 nos
06	Drawing Sheet	Good quality drawing sheet, tinted off white.	1 nos
07	Clamps	Clamps of suitable size	4 nos.

VIII. Precautions to be followed:

1. Set the instrument exactly over the station on ground.
2. Perform temporary adjustment accurately.
3. Alidade should be properly placed while bisecting the objects.
4. Measure the distances on the ground correctly.
5. Take suitable scale for plotting.
6. Perform survey during dry weather.

IX. Procedure:

1. Collect the required instruments as per Table IX from the store
2. Select the station points A and B in such a way that both are indivisible and station P is also visible from stations A and B.
3. Setting up the plane table over the station A and perform temporary adjustment, i.e., levelling and centring of the table. Transfer station A from ground to sheet as 'a' and mark north direction at top right comer.
4. With alidade touching station 'a', bisect the ranging rod held at station B. measure distance AB on the ground and mark the position 'b' on drawing sheet..
5. Alidade touching with 'a' bisect ranging rod at P and draw ray 'ap'.
6. Shift the instrument at station B and perform orientation by back sighting or magnetic meridian method
7. With alidade touching station 'b', bisect the ranging rod at station P. Draw ray 'bp'. The intersection of 'ap' and 'bp' is the position of station P on drawing sheet.
8. Return the instruments to the survey store.

X. Results:

- Polygon plotted drawing sheet.

XI. Interpretation of results:

XII. Conclusions:

XIII. Practical Related Questions:

1. State method of orientation adopted while locating objects by method of intersection.
2. Mention differences between telescopic alidade & plane alidade.
3. State the precaution to be taken in intersection method of plane tabling.

Space for Answer

XIV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 20 **Prepare traverse using Plane table Surveying.**

I. Practical Significance:

When the considerable area to be surveyed and available time is less than this traversing method of plane table surveying is the most suitable method. In large area important points surveyed or missing are quickly identified. Field work & plotting work is done simultaneously in plane table survey. Concept of orientation of plane tabling is very well understood during the process. After knowing this method of plane tabling students will be able to select appropriate method of surveying as per field situation.

II. Industry/Employer expected outcome(s):

- Prepare plan by plane table survey with present field situation.

III. Course Level Learning Outcome (COs):

- CO 5- Prepare the plan using Plane Table Surveying to locate relevant details.

IV. Laboratory Learning Outcome (LLO):

- LLO 20.1 Use plane table survey to prepare plan and locate details by using Traversing Method.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Parallelism is the principle of plane table survey. Information of all the accessories of plane table with their use is necessary. Similarly different methods of plane tabling with their suitability under different field situation must be known. Traversing method is generally adopted when considerable area to be surveyed and available time is less.

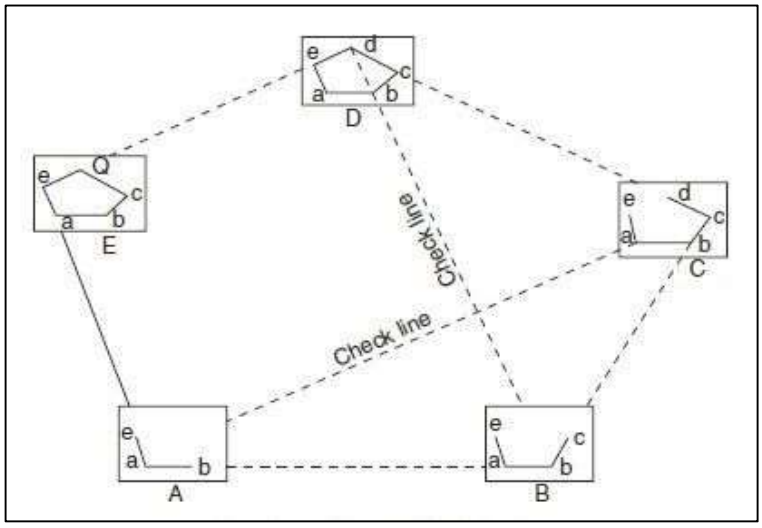


Figure No. 20.1 Traversing method of Plane Table Survey

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Plane table	Well-seasoned, good quality drawing board made of pine or teak wood having smooth, plane finish on its top and fitted with ball and socket arrangement or a levelling head, varying in size from 75cm X 60cm X l .5cm or 60cmX50cmXl.5cm or 50cm X 40cm X 1.5cm	1 nos.
02	Plane/ telescopic Alidade	A plane alidade metallic (brass or gunmetal) or good quality wooden rule with a fine beveled edge.A telescopic alidade consists of a telescope which provides a very accurate line of sight. The telescope is fitted onto an A- frame which is fitted onto a heavy rule.	1 nos.
03	Spirit level	Tubular level, which can be placed into perpendicular position.	2 nos.
04	Trough compass	Usually it is 15cm long and provided with magnetic needle to facilated orientation of the plane table and to mark north direction.	1nos
05	U-frame or Plumbing fork	It is a hairpin-shaped brass frame having two arms of equal length one end of frame is pointed, the end of the frame carries a plumb-bob.	1 nos
06	Drawing Sheet	Good quality drawing sheet, tinted off white	1 nos
07	Clamps	Clamps of suitable size	4 nos.

VIII. Precautions to be followed:

1. Set the instrument exactly over the station on ground
2. Perform temporary adjustment accurately.
3. Alidade should be properly placed while bisecting the objects
4. Measure the distances on the ground correctly
5. Take suitable scale for plotting
6. Perform survey during dry weather.

IX. Procedure:

1. Collect the required instruments as per Table VII from the store
2. Select the station points A, B, C, D and E in such a way that adjoining stations are inter
    a. Visible from the instrument station.
3. 11 Set up the plane table over the station A and perform temporary adjustment, i.e. Levelling and
    a. Centring of the table. Mark north direction with trough compass at right top corner.
    b. Simultaneously Transfer station A from ground to sheet as 'a'.
4. With alidade touching station 'a', bisect the ranging rod held at station B. measure distance AB on the ground and mark the position 'b' on drawing sheet..
5. Shift the instrument at station B and perform temporary adjustment and orientation by
    a. Back sighting or magnetic meridian method. And continue the same procedure at
    b. C, D, and E
6. Return the instruments to the survey store.

X. Results:

- Polygon plotted drawing sheet.

XI. Interpretation of results:

XII. Conclusions:

XIII. Practical Related Questions:

1. State the suitability of Traversing method
2. Which method of orientation is more accurate? Justify.

Space for Answer

XIV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

Practical No: 21 **Prepare plan to establish plant nursery.**

I. Practical Significance:

In nursery plants are grown under controlled atmospheric conditions & then planted in the field. The area selected for nursery is generally a plane levelled area. Locate the total nursery plant area, road area, office area etc. by using plane table.

II. Industry/Employer expected outcome(s):

- Select the relevant method of plane tabling for a given situation.

III. Course Level Learning Outcome (COs):

- CO 5- Prepare the plan using Plane Table Surveying to locate relevant details.

IV. Laboratory Learning Outcome (LLO):

- LLO 21.1 Use plane table survey to prepare plans plan to establish plant nursery.

V. Relevant Affective Domain related Outcome(s):

- Using Safe behaviors effectively.
- Maintain high standards of hygiene.
- Efficient application of tools, equipment's and machinery.
- Professional and ethical standards.

VI. Relevant Theoretical Background:

Plant nursery area is divided into various compartments like production area, sales area, parking area office area, internal roads, growing out area, water tank area, storage area, etc. Plane table survey is suitable to plan a proper layout as per the prevailing field situations.

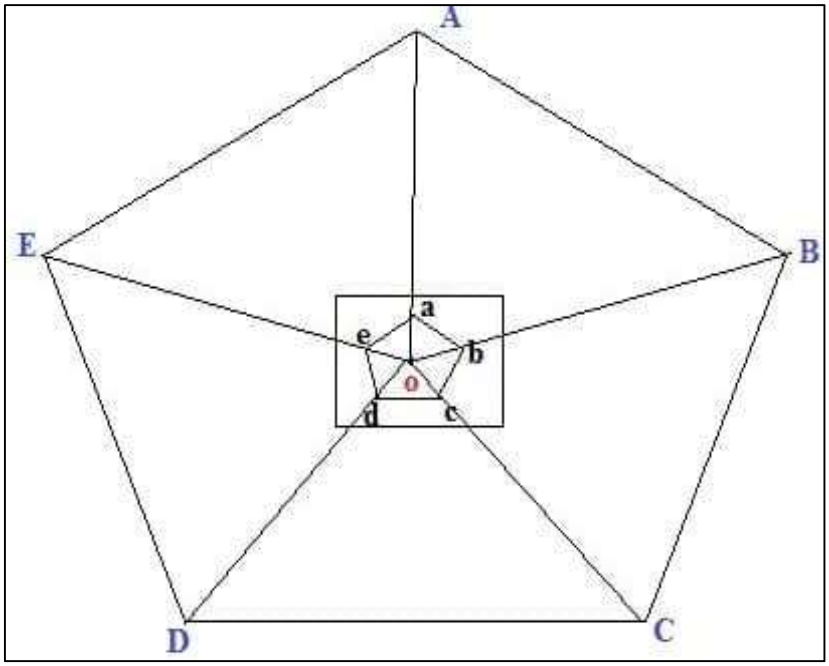


Figure No. 18.1 Radiation method of Plane Table Survey

VII. Required resources/equipment:

Sr. No.	Resource required	Particulars	Quantity
01	Plane table	Well-seasoned, good quality drawing board made of pine or teak wood having smooth, plane finish on its top and fitted with ball and socket arrangement or a levelling head, varying in size from 75cmX60cmX 1 .5cm or 60cmX50cmXl.5cm or 50cm X 40cmX 1.5cm	1 nos.
02	Plane/ telescopic Alidade	A plane alidade metallic (brass or gunmetal) or good quality wooden rule with a fine beveled edge.A telescopic alidade consists of a telescope which provides a very accurate line of sight. The telescope is fitted onto an A- frame which is fitted onto a heavy rule	1 nos.
03	Spirit level	Tubular level, which can be placed into perpendicular position	2 nos.
04	Trough compass	Usually it is 15cm long and provided with magnetic needle to facilated orientation of the plane table and to mark north direction	1nos
05	U-frame or Plumbing fork	It is a hairpin-shaped brass frame having two arms of equal length one end of frame is pointed, the end of the frame carries a plumb-bob	1 nos.
06	Drawing Sheet	Good quality drawing sheet, tinted off white	1 nos.
07	Clamps	Clamps of suitable size	4 nos.

VIII. Precautions to be followed:

1. Set the instrument exactly over the station on ground
2. Perform temporary adjustment accurately.
3. Alidade should be properly placed while bisecting the objects
4. Measure the distances on the ground correctly
5. Take suitable scale for plotting
6. Perform survey during dry weather

IX. Procedure:

1. First visit the site & observe the field situation
2. Mark the extreme boundaries of the area where plant nursery is planned
3. Set up the plane table & carry out all temporary adjustments
4. Set up the plane table in the field from which all established boundary points are visible.
5. Adopt radiation method of plane tabling & draw rays, measure field distances.
6. Plot boundary points on sheet & find total area of field
7. Consider all requirements & future plans for plant nursery & allot the required area for individual component
8. 24 Divide the area into parts & draw layout for nursery.
9. 25 Return all the instruments to survey store.

X. Results:

- Layout of plant nursery.
- Total area =

XI. Interpretation of results:

XII. Conclusions:

XIII. Practical Related Questions:

1. State the component parts of nursery and min area required
2. State the factors to be taken into consideration while marking layout of plant nursery.

Space for Answer

XIV. Assessment Scheme

Sr. No.	Performance Indicators	Weightage	Marks Obtained
A.	**Process Related (15 marks)**	**60%**	
1.	Handling of equipment's & Survey Conduction	40%	
2.	Accuracy in length measurement.	20%	
B.	**Product Related (10 marks)**	**40%**	
3.	Conclusion of practical	20%	
4.	Practical Question Answer	20%	
C.	**Total marks (25 marks)**	**100%**	

Marks Obtained			Dated sign of Teacher
Process Related (15)	**Product Related (10)**	**Total (25)**	

List of Compulsory Project:

Sr. No.	Practical No.	Title of Project	Mapping LLO
01	09	**Project 01:-** Use transit theodolite to carry out Survey Project for closed traverse for minimum 5 sides.	LLO 9.1 Prepare traverse using Transit theodolite.
02	13	**Project 02:-** Profile leveling and cross-sectioning for a road length of 300 m with cross-section at 20 m interval.	LLO 13.1 Perform Road profile and cross section of given terrain.
03	16	**Project 03:-** Plotting contour map using block contouring method for a block of 150m x 150m with grid of 10m x 10m for given land parcel.	LLO 16.1 Prepare Contour Plan/map using block contouring method.