MANUAL

OF

SURVEYING

LABORATORY

Department of civil Engineering

Government Co-Education Polytechnic, Raipur C.G

INDEX

S/NO.	NAME OF EXPERIMENT	DATE	SIGN	REMARK
1.	Chain surveying : 1. Ranging a line. 2. Chaining a line and recording in the field book. 3. Taking offsets-Perpendicular and oblique (with a tape only). 4. Chaining a line involving obstacles to ranging.			
2.	To fix station point and to measure length of a line by direct ranging with the help of chain and tape and plot it.			
3.	To perform a chain survey of closed traverse fixing the angle between two chain lines by the tie lines and to plot them and adjusting the closing error by graphical method.			
4.	To perform a chain survey of an area by chain triangulation and plot.			
5.	Study the parts of prismatic compass and to measure the bearings of lines joining different station points.			
6.	To take the fore bearing and back bearing of sides of a regular polygon and to calculate included angle and check them.			
7.	To perform a chain and compass survey of an area by open traverse and prepare a map.			
8.	To perform a chain and compass survey of an area by closed traverse and prepare a map.			
9.	To learn temporary adjustment of levelling instrument and to find the R.L. of the given point.			
10.	To find the difference of R.L. of two given point by shifting of instrument on change points and applying arithmetical check.			

11.	To take the longitudinal and cross-section levels of an existing road.			
12.	To take the block leveling of undulated site and to draw the contours using method of interpolation.			
13.	Preparing a contour map of a small area by direct method of contouring.			
14.	To draw contour map of a small pond and to calculate its capacity.			
15.	To study a Topo sheet of certain area and to mark on it water shed line and find out catchments area of a stream at a place.			
16.	To study the accessories of plane table surveying and to plot the objects by radial method.			
17.	To perform the plan table survey of small area by intersection method.			
18.	Study of minor instruments.			

Experiment No. 1

Object: Chain surveying:

1. Ranging a line.

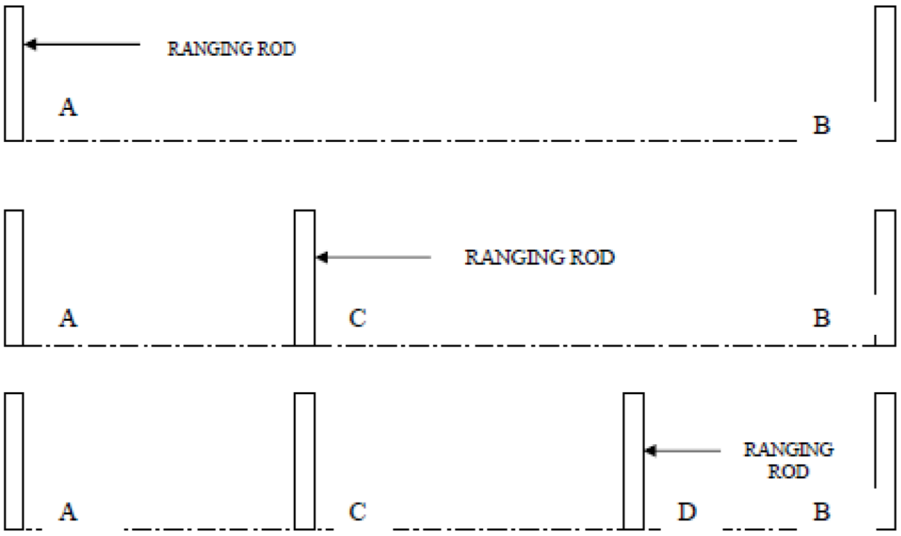
2. Chaining a line and recording in the field book.

3. Taking offsets-Perpendicular and oblique (with a tape only).

4. Chaining a line involving obstacles to ranging.

INSTRUMENTS:

Chain 20m / 30m	01 Nos.
Arrows	10 Nos.
Ranging rods	04 Nos.
Pegs	02 Nos.



PROCEDURE:

» Fix the ranging rods at the two given stations, where pegs are already driven on the ground.

» The follower stand behind station A and directs the leader, with ranging rod to come in line with AB by signals of ranging.

» When the ranging rod comes in the line of AB the follower directs the leader to fix the ranging rod in position.

» Let the intermediate point be C which should be less than 20m / 30 m . » Now the leader taken another ranging rod and stands between A and B about 2/3 distance from A

» The follower directs the leader to come in line of AB by using signals of ranging.
» As and when the point is located in the line of AB the follower instructs to fix the ranging rod in position.

» Let the other intermediate position be D which is less than 20 m / 30 m from B

» Now A, B, C and D are in one line.

Now the leader and follower measure the distance by measuring along A, C, D, B.

RESULT: The distance between AB = _____ meter.

FIELD APPLICATION:

» It can be extended to measure the lengths of more than two chain lengths.

» By measuring the boundaries of given traverse the areas can be calculated.

» The features can be located either by measuring oblique or perpendicular offset from the chain line.

EXPERIMENT No.-02

Object: To fix station point and to measure length of a line by direct ranging with the help of chain and tape and plot it.

INSTRUMENTS:

1. Ranging rod ……5 Nos.
2. 30 m Chain……..1 Nos.
3. Arrow……5 Nos. (min.)

PROCEDURE:

1. First of all first ranging rod is established at known point A and its ranging rod should be fixed at point A up to completion of work.
2. Second ranging rod is established at known point B (or at known object) and a ranging rod should be fixed at point B up to completion of work.
3. Third ranging rod established at point P (or any) approximately on the line of point AB (by judgment) and it's not greater than one chain length from point A.
4. Measure the distance of AP by chain and move ranging rod at point P to its next position and establishing a wooden peg or arrow at point P.
5. Third ranging is established at point Q (or any) approximately on the line of point AB (by judgment) and it's not greater than one chain length from point P.
6. Measure the distance of PQ by chain and move ranging rod at point Q to its next position and establishing a wooden peg or arrow at point Q.
7. Its procedure repeats up to reaching point B.
8. Third ranging rod is established at known point C (or at known object) and a ranging rod should be fixed at point C up to completion of work.
9. Fourth ranging rod established at point P' (or any) approximately on the line of point BC (by judgment) and it's not greater than one chain length from point B.
10. Measure the distance of BP' by chain and move ranging rod at point P' to its next position and establishing a wooden peg or arrow at point P'.
11. Fourth ranging is established at point Q' (or any) approximately on the line of point BC (by judgment) and it's not greater than one chain length from point P'.
12. Measure the distance of P'Q' by chain and move ranging rod at point Q' to its next position and establishing a wooden peg or arrow at point Q'.
13. Its procedure repeats up to reaching point C.

14. Fifth ranging rod established at point P" (or any) approximately on the line of point CA (by judgment) and it's not greater than one chain length from point C.

15. Measure the distance of CP" by chain and move ranging rod at point P" to its next position and establishing a wooden peg or arrow at point P".
16. Fifth ranging is established at point Q" (or any) approximately on the line of point CA (by judgment) and it's not greater than one chain length from point P".

17. Measure the distance of P"Q" by chain and move ranging rod at point Q" to its next position and establishing a wooden peg or arrow at point Q".

18. Its procedure repeats up to reaching point A.

19. Finally complete a triangle and position of point A, B, and C is known respect to each other.

Observation table:

S.No.	Main Line or Grid line	Intermediate Line	Distance of Intermediate point	Total length of Grid line

EXPERIMENT No.-03

Object :To perform a chain survey of closed traverse fixing the angle between tie chain lines by tie lines and to plot them and adjusting the closing error by graphical method.

Apparatus:

Prismatic compass, pegs, ranging rods etc.

Theory: Surveying which involves series of connected lines is known as traversing. The sides of traverse are known is known as Traverse legs.

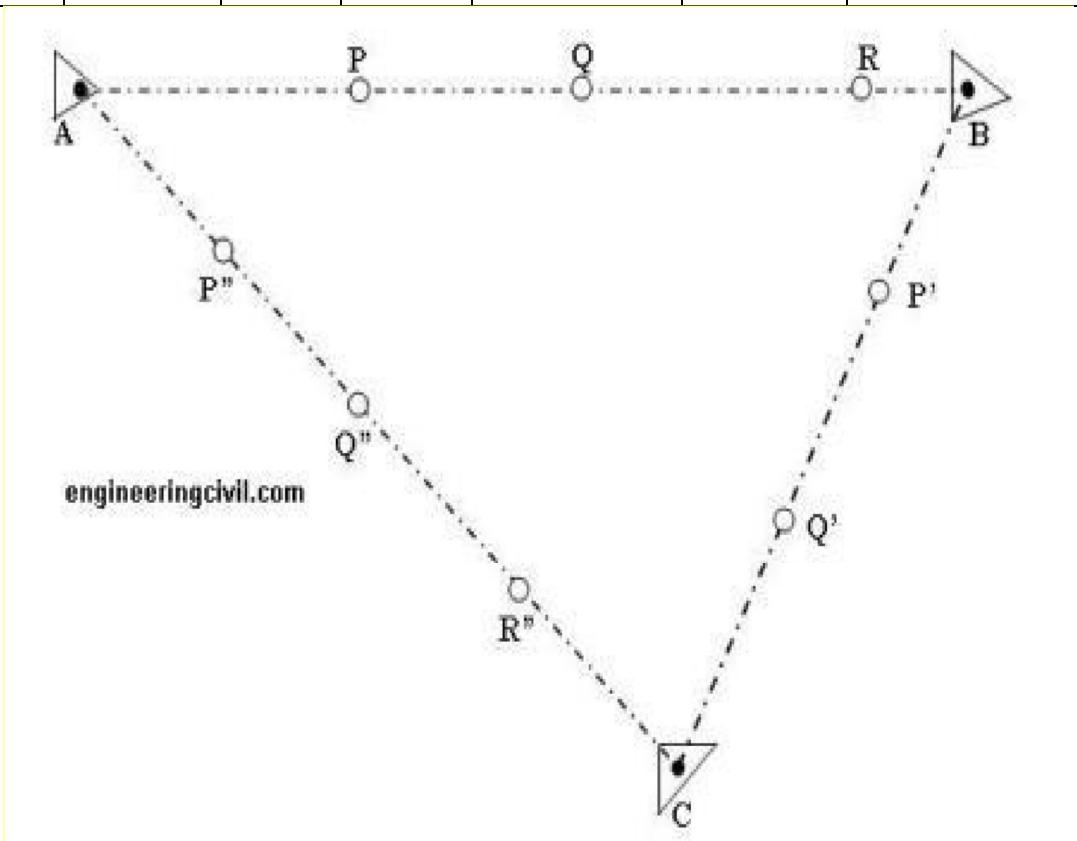
In traversing with a compass free or loose needle method is employed to determine direction of survey line. The compass is setup at each of the successive station and fore & back bearing of each line is determined All the readings are noted in field book. Each of the line is observed independently & errors are calculated, compensated. The field work consists of primary survey, marking of stations, running of traverse lines.

Procedure:

- Let us say we have to run a closed compass traverse ABCDEA. Set the prismatic compass at point A. center it and level it.
- Take bearings of traverse lines AB and AE.
- Shift the compass to point B center it and level it. Take the bearings BC and BA.
- Link-wise complete the traverse as shown in fig (a).
- Measure the length of traverse line AB, BC, CD, DE, and EA.
- Record the observation in tabular columns.
- Care must be taken to see that the stations are not affected by local attractions. If they are affected corrections to local attractions should be applied first and then the traverse should be plotted with corrected bearings.
- Simplest method of plotting is angle and distance method with a protractor. If Last point is falling short by some distance in meeting the first point then it means that there is a Closing error.

  So, traverse should be adjusted by “Bow ditch’s graphical method”

S.No	Station	point	Line	Fore Line bearing	Back bearing	Difference Correction at Station	Corrected fore bearing



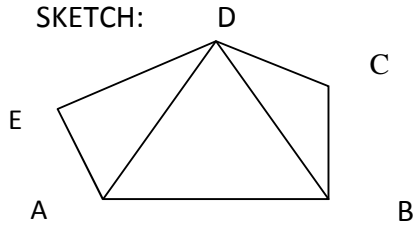
Experiment No.-04

Object: To perform a chain survey of an area by chain triangulation and plot.

Instrument:

Chain 20m / 30m	1 No.	Arrows	10 Nos.
Ranging rods	6 Nos.	Pegs	5 Nos.

SKETCH:



PROCEDURE:

» Let ABCDE be the given field whose area is to be measured, fix the pegs at A, B, C, D & E.

» Divide area into three triangles ADE, ABD and BCD by joining AD and BD.

» Measure the lengths AB, BC, CD, DE, EA, AD and BD.

» Calculate the area of the triangles.

» The sum of the areas of the three triangles is the area of the given field.

FORMULA:

Area of the triangle Δ = $\sqrt{s\,(s-a)\,(s-b)\,(s-c)}$

Where

S = (a + b+ c) / 2 A, b, c, are the sides of the triangle.

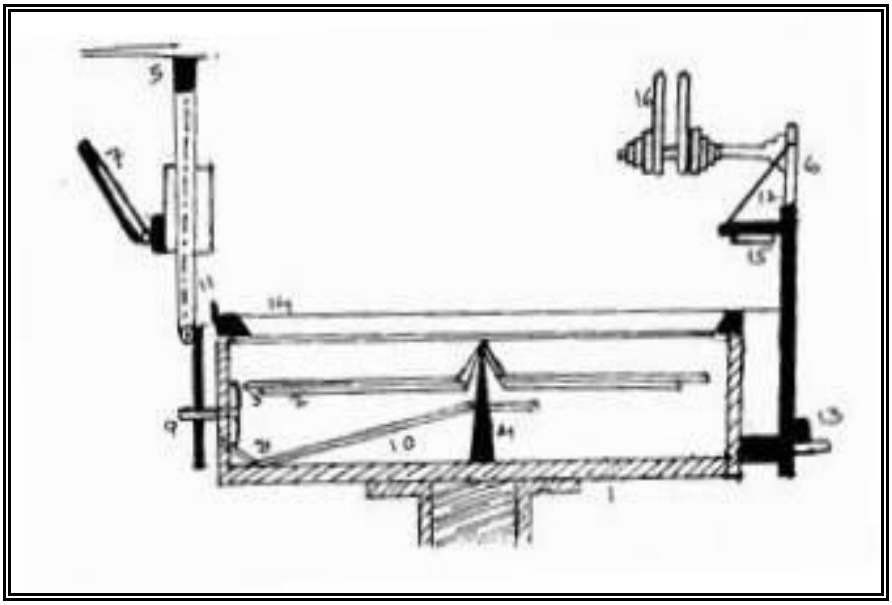
RESULT:

The area of the given field =_____Square meter.

Experiment No.-05

Object: Study the parts of prismatic compass and to measure the bearings of Lines joining different station points.

SKETCH:



Parts List

1. Compass Box	2. Magnetic Needle	3. Graduated Ring
4. Pivot	5. Objective Vane	6. Eye Vane
7. Adjustable Mirror	8. Spring Brake	9. Brake Pin
10. Lifting Lever	11. Lifting Pin	12. Prism
13. Focusing Stud	14. Glass Cover	15. Prism Dust Cap
16. Sun Glasses		

DESCRIPTION OF INSTRUMENTS

COMPASS BOX: It is a circular box of diameter 85 to 110 mm having pivot at the center and covered with plain glass at top.

MAGNETIC NEEDLE: It facilitates in taking the bearings of survey lines with reference to the magnetic north.

PIVOT: Magnet is freely held with this.

OBJECT VANE: It consists of prism with a sighting slit at the top. The prism magnifies and erects the inverted graduations.

BRAKE PIN: It is pressed to stop the oscillations of the graduated ring.

LIFTING PIN: On pressing it brings the lifting lever into action.

COLOUR GLASSES: Red and blue glasses are provided with the prism to sight luminous

Experiment No.-06

Object: To take the fore bearing and back bearing of sides of a regular polygon and to calculate included angle and check them.

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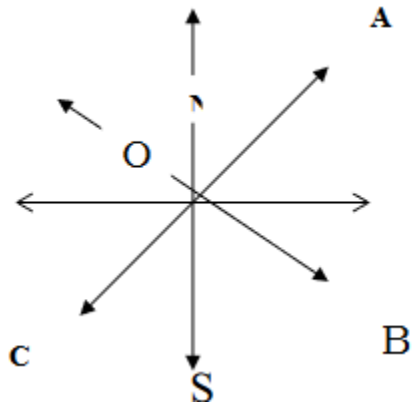
INSTRUMENTS:

Prismatic compass, tripod, tape, chain, arrows and ranging rods.

SKETCH:



» Let 'O' be the instrument station selected from which all other points are visible.

» Complete all station adjustments like setting, centering and leveling accurately.

» Sight the object 'A' looking through the prism vane, while the object vane is directed towards the object.

» Observe the bearing by looking through the prism. Enter the readings in the tabular form.

» Repeat the process at all objects stations B,C,D etc and enter the readings.

FORMULA:

Included angle: bearing of 2 nd line bearing of first line.
(If the value is more than 180º than subtract the value from 360º).

TABULAR FORM

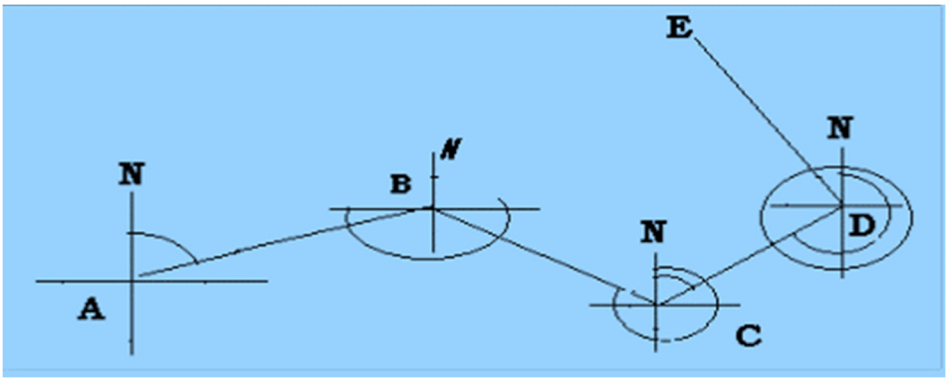
Sl.No.	Station	Sighted to	W.C.B.

EXPERIMENT-07

OBJECT-To perform a chain and compass survey of an area by open traverse and prepare a map.

INSTRUMENTS: Prismatic compass, tripod, tape, chain, arrows and ranging rods.

SKETCH:



PROCUDURE:

» Set the instrument at the starting station ‘A’ and perform all the necessary adjustments.

» Sight the next station ‘B’, take fore bearing of ‘AB’ and measure the distance ‘AB’.

» Take F.B of ‘AE which provides check; similarly bearing of any line AC,CE, ... etc. also provides the check.

» Shift the instrument to subsequent station ‘B’. After fixing the instrument sight the previous station ‘A’ and observe the reading, which gives the B.B. of AB.

» Sight next station ‘C’ observe F.B of BC and measure the distance BC.

» Locate the details surrounding the traverse station if necessary, by taking bearings or lengths or both from chains line.

» Repeat the process at every station

» It is to be noted that first and last stations have only fore bearing and back bearings respectively.

» Take Back bearings of the first point from the last point.

» Enter the reading in a tabular form.

Sl.No.	Line	Length	F.B.	B.B.	Remarks
1.	AB				
2.	BC				
3.	CD				
4.	DE				

CHECK:

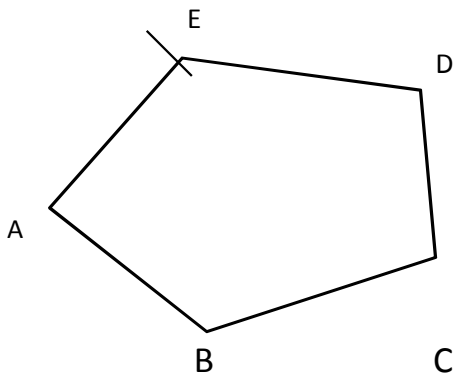
The difference between fore bearing and back bearing of each line should be 180º, if no local attraction exists at either station.

Experiment No.-08

OBJECT: To perform a chain and compass survey of an area by close traverse and prepare a map.

INSTRUMENTS: Prismatic compass, chain, ranging rods.

SKETCH:



PROCEDURE:

- Fix the closed traverse A B C D E.
- Set up the compass at the station 'A'.
- Perform the temporary adjustments.
- Sight the object at 'B' and note down the FB of line AB and measure the distance.
- Sight the object at E and note down the BB of EA.
- Sight the instrument to station 'B' performs all the temporary adjustments.
- Sight the object at 'A' and take the 'BB' of 'AB'.
- Take 'FB' of 'BC' and measure the length of 'BC'.
- Check whether the difference of 'FB' and 'BB' is 180º or not, at all stations.
- Continue the same process all at other stations.

TABULAR FORM FOR CLOSED TRAVERSE

S/No.	Line	Length	F.B.	B.B	Remarks

FORMULA:

Included angle = B.B of previous line – F.B of next line.

CHECK:

The sum of the included angles should be equals to (2n-4) x 90º

Where ‘n’ is number of sides of the traverse.

Experiment No.-09

OBJECT: To learn temporary adjustment of leveling instrument and to find the RL of the given point.

Experimental Setup: Dumpy level, Tilting level, Auto level, measuring staff, tripod stand.

Theory:

Leveling - The art of determining and representing the relative height or elevation of different object/points on the surface of earth is called leveling. It deals with measurement in vertical plane. By leveling operation, the relative position of two points is known whether the points are near or far off. Similarly, the point at different elevation with respect to a given datum can be established by leveling.

Level: An instrument which is used for observing staff reading on leveling staff kept over different points after creating a line of sight is called a level.

The difference in elevation between the point then can worked out. A level essentially consists of the following points:

Telescope: Telescope consists of two tubes, one slide into the other and fitted with lens and diaphragm having cross hairs. It creates a line of sight by which the reading on the staff is taken. The essential parts of a telescope are:

1) Body
2) Object glass
3) Eye-piece
4) Diaphragm
5) Focusing screw
6) Leveling Heads
7) Limb plate
8) Diaphragm screw
9) Bubble tube
10) Tripod stand

2) Dumpy Level: The dumpy level is simple, compact and stable instrument. The telescope is rigidly fixed to its supports. Hence it cannot be rotated about its longitudinal axis or cannot be removed from its support. The name dumpy is because of its compact and stable construction. The axis of telescope is perpendicular to the vertical axis of the level. The level tube is permanently placed so that its axis lies in the same vertical plane of the telescope but it is adjustable by means of captain head not at one end. The ray shade is provided to protect the object glass. A clamp and slow motion screw are provided in modern level to control the movement of spindle, about the vertical axis. The telescope has magnifying power of about thirty diameters. The level tube is graduated to 2mm divisions and it has normally a sensitiveness of 20 seconds. The telescope may be internally focusing or external focusing type.

Use of Dumpy Level:

Dumpy level is an important leveling instrument used in many engineering works such as roads, railways, dams, canals, water supply and sanitary schemes. It is used to find the difference in elevation between two or more points, to establish new bench marks, undulations of earth's surface for alignment of roads, railways, locating gradient lines of pipe lines, and sewers. It is used for layout and construction of buildings, bridges. It is used to prepare contour maps, to find catchment area, capacity of a proposed tank, reservoir, and earthwork quantities for roads, railways. The success of any engineering project entirely depends upon its accurate and complete leveling work.

Adjustment of the level:

The level needs two type of adjustment

1) Temporary adjustment and

2) Permanent adjustment

Temporary adjustments of dumpy level: These adjustments are performed at each set-up the level before taking any observation

A) Setting up the level: - This includes,

1. Fixing the instrument on the tripod: -The tripod legs are well spread on the ground with tripod head nearly level and at convenient height.

2. **Leg adjustment:** - Bring all the foot screws of the level in the center of their run .Fix any two legs firmly into the ground by pressing them with hand and move the third leg to leg to right or left until the main bubble is roughly in the center. Finally the legs are fixed after centering approximately both bubbles. This operation will save the time required for leveling.

B) Levelling: - Levelling is done with the help of foot screws and bubbles. The purpose of levelling is to make the vertical axis truly vertical. The method of leveling the instrument.

Depends upon whether there are three foot screws or four foot screws. In all modern instruments three foot screws are provided and this method only is described.

1. Place the telescope parallel to pair of foot screws.
2. Hold these two foot screw between the thumb and first finger of each hand and turn them uniformly so that the thumbs move either toward each other until the bubble is in center.
3. Turn the telescope through 90°so that it lies over the third foot screw.
4. Turn this foot screw only until the bubble is centered.
5. Bring the telescope back to its original position without reversing the eye piece and object glass ends.
6. Again bring the bubble to the center of its run and repeat these operation until the bubble remains in the center of its run in both position which are at right angle to each other.
7. Now rotate the instrument through 180°, the bubble should remain in center provided the instrument is in adjustment: if not, it needs permanent adjustment The plane of collimation system (H.I. method):

<u>In this system, the R.L. of plane of collimation (H.I) is found out for every set-up of the level and then the reduced levels of the points are worked out with the respective plane of collimation as described below.</u>

1. Determine the R.L. of plane of collimation for the first set up of the level by adding B.S. to the R.L. of B.M. i.e. (R.L of plane of collimation= R.L. of B.M. + B.S.)

2. Obtained the R.L. of the intermediate points and first change point by subtracting the staff readings (I.S. and F.S. from the R.L. of plane of collimation (H.I). (R.L. of a point=R.L of plane of collimation H.I. - I.S or F.S)
3. When the instrument is shifted and set up at new position a new plane of collimation is determined by addition of B.S. to the R.L of change point. Thus the levels from two setups of the instruments can be correlated by means of B.S. and F.S. taken on C.P.
4. Find out the R.L.s of the successive points and the second C.P. by subtracting their staff readings from this plane of collimation R.L.
5. Repeat the procedure until all the R.Ls are worked out.

Observation Table:

A) Dump level

Station	Reading			R.L. of plane collimation (H.I)	Reduced Level	Remark
	BS	IS	FS			

Experiment No.-10

OBJECT: To find the deference of RL of two given point by shifting of instrument on change points and applying arithmetical checks.

Theory: Bench mark – Types, Simple leveling

Instruments: Dumpy level, Leveling staff.

Exercise:

I. a) Identify the points A and B between which difference in elevation is required.

b) Setup dumpy level at a convenient position.

c) Take staff readings on A and B.

II. a) Identify the points A and B (bottom of chejja).

b) Set up dumpy level at a convenient position.

c) Take staff reading on A and B (Staff inverted).

III. a) Identify B.M; points A and B

b) Set up the dumpy level at a convenient position. Perform temporary adjustments.

c) Take staff readings B.M, A and B.

d) Compute the R.L.

Observation and calculations:

a) Staff readings on 'A' = _____ m

Staff readings on 'B' = _____ m

Difference in elevation between A and B = _____ m

b) Staff readings on 'A' = _____ m

Staff readings on 'B' = _____ m

Difference in elevation between A and B = _____ m

BS	IS	FS	HI	RL	REMARK

Arithmetic checks:

EXPERIMENT No.-11

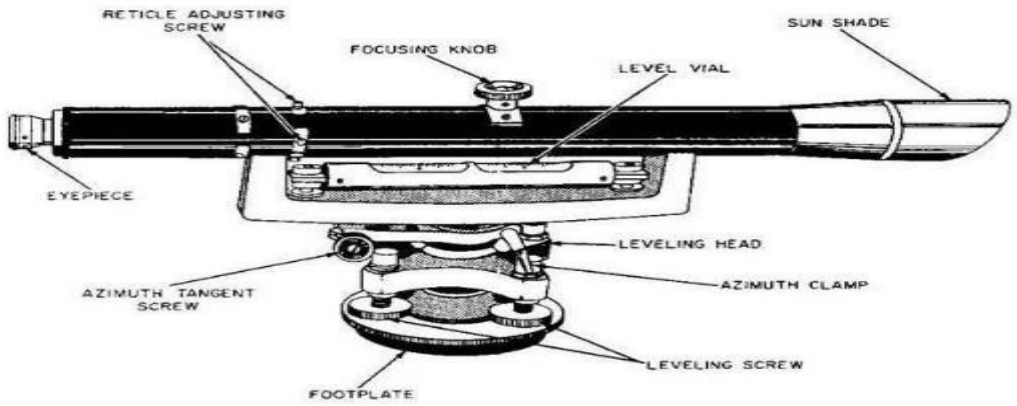
OBJECT: To take the longitudinal and cross- section levels of an existing road.

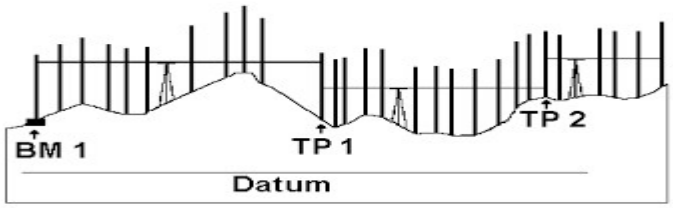
RESOURCES:

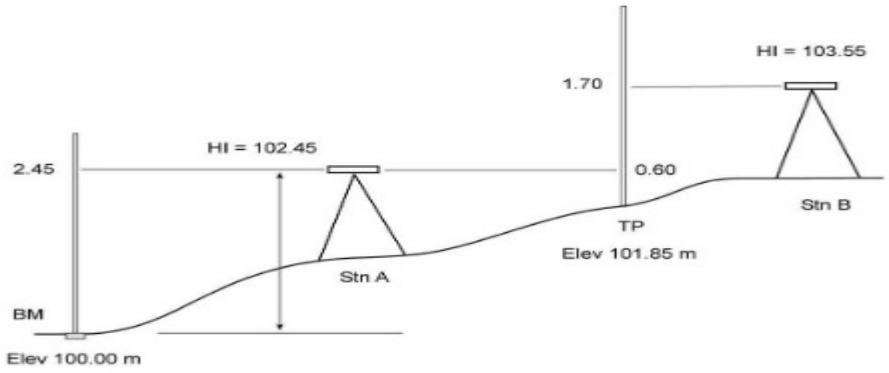
S. No.	Name of the Equipment	Range	Type	Quantity
1	Dumpy level			1
2	Ranging Rods		3m or 2m height	3
3	Arrows			5
4	leveling staff	Folding staff	4m	1
5	Tripod		Dumpy level Tripod	1

FIGURE:

A dumpy level, builder's auto level, leveling instrument, or automatic level is an optical instrument used to establish or check points in the same horizontal plane. It is used in surveying and building with a vertical staff to measure height differences and so transfer, measure and set heights. A Dumpy level is shown in figure below.







Procedure:

1. Profile leveling is a method of surveying that has been carried out along the central line of a track of land on which a linear engineering work is to be constructed/ laid. The operations involved in determining the elevation of ground surface at small spatial interval along a line is called profile leveling.
2. Divide the proposed center line of a given work at regular intervals.
3. Fix the level and do station adjustments.
4. Take Back Sight on Bench Mark.
5. Take Intermediate Sight on intermediate point
6. Take Fore Sight on Change points and End point.
7. Record the values in field book in respective columns.

CALCULATIONS:

St. No.	Left	Centre	Right	BS	IS	FS	HI	RL	Remarks

ARITHMETIC CHECK:

Σ B.S – ΣF.S = Last R.L – First R.L.

RESULT:

The longitudinal and cross sectional profile of a given area is plotted on graph.

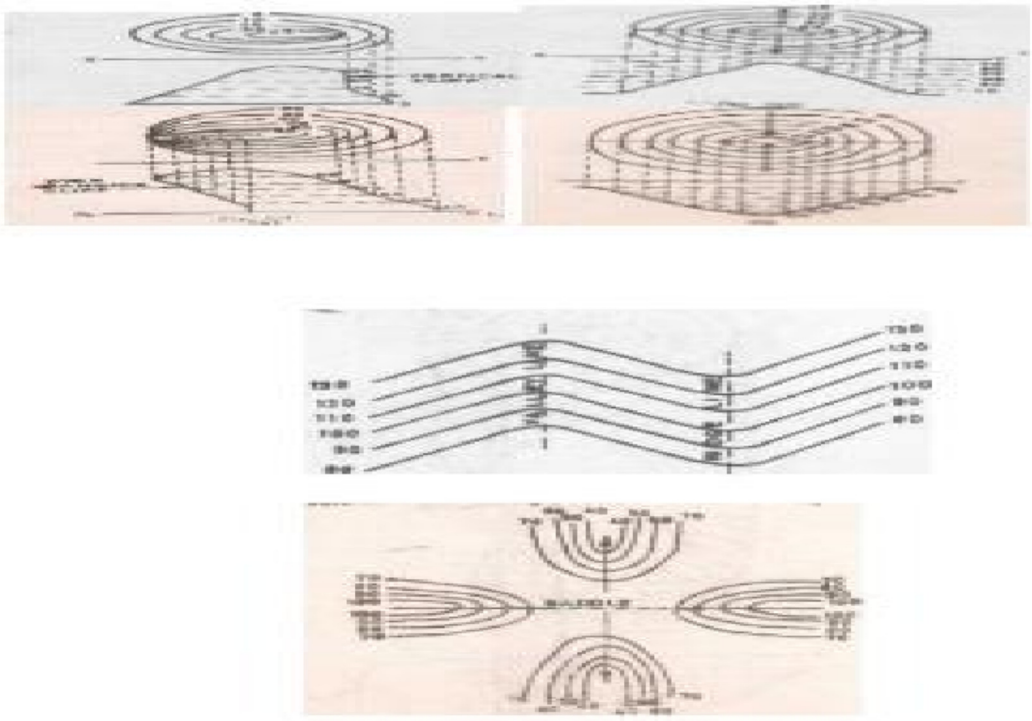
EXPERIMENT No.-12

OBJECT: To take block leveling of undulated site and to draw the contours using method of Interpolation.

RESOURCES:

S. No.	Name of the Equipment	Range	Type	Quantity
1	Dumpy level			1
2	Ranging Rods		3m or 2m height	3
3	Arrows			5
4	leveling staff	Folding staff	4m	1
5	Tripod		Dumpy level Tripod	1
6	prismatic compass			1
7	chain		20m	1
8	Tape		20m	1

FIGURE:



Theory:

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

Characteristics of Counter Lines:

The following are the Characteristics of the contours/ contour lines.

1. All points on the same contour line will have the same elevation.
2. Contour lines close together represent steep ground, while uniform slope is indicated when they are uniformly spaced. A series of straight, parallel and equally spaced contours show a plane or flat surface.
3. Contour lines of different elevation cannot merge or cross one another on the map, expect in the case of an overhanging cliff. A vertical cliff is indicated when several contours coincide.
4. A contour line must close upon itself either within or without the limits of the map.
5. Series of closed contour lines on the map either represent a hill or a depression according as the higher or lower values are inside them as shown in figs.
6. A contour will not stop in the middle of the plan. It will either close or go out of the plan.
7. Ridge or water shad and valley lines are the lines joining the top most or the bottom most points of hill and valley respectively, cross the contours at right angles. A ridge line is shown when the higher values are inside the loop, while in the case of a valley line, the lower values are inside the loop as shown in figure.

Procedure:

a) Cross-section method: This method is commonly used in rough survey, cross sections are run traverse to the contour line of road, and railway as canal and the point of change of slope (representations) are located. The cross-section line may be inclined at any angle to the centerline if necessary. The spacing of the cross sections depends upon the characteristics of the ground. By interpolation of contour is meant the process of spacing the contour proportioning between the plotted ground points. Contour may be 66 interpolated by

1) Estimation
2) Arithmetical calculations
3) Graphical method.

In all these methods it is assumed that the slope of the ground between any two random points is uniform.

RESULT:

The contour of given land is drawn in the sheet.

PRECAUTIONS:

2. Staff must be vertical while taking reading.
3. Leveling must be done carefully.
4. Readings must be taken with full accuracy
5. Temporary adjustments must be done carefully

EXPERIMENT-13

OBJECT- Preparing a contour map of a small area by direct method of contouring.

Apparatus: Dumpy Level, Staff, and tape.

Theory:

Contour is an imaginary line in the ground joining the points of equal elevations. Contour may be drawn by the direct and indirect method. Generally indirect methods have been used for contouring. In these methods some guide points are selected and surveyed. These guide points have been plotted on the map, which serves as basis for interpolation.
By square method: In this method the area to be surveyed is divided into a number of squares of size 5 to 20 meters depending upon the nature of contour and contour interval. The elevations are determined by staff and level and contours may be plotted by interpolation. Interpolation has been done by estimation assuming that the slope of ground between the points is uniform.

Procedure:

1. Mark a square area of size 20 m X 20 m (approximate) with the tape and divide it into squares of 1m X 1m and fix arrows at every corner of small squares.
2. Locate the position of end corners of big square on the sheet by plane tabling.
3. With the help of dumpy level and staff find the elevation of all the points marked previously.
4. Write the spot elevations of respective points on the sheet.
5. Using method of estimation draw contours at appropriate intervals.

Precautions:

- In case of dumpy level, it is to be fixed at a point from where it can take maximum readings.
- Instrument should be leveled properly.
- Bubble should be in centre before taking reading.
- Staff should be held vertical.

Applications:

Contour maps have many uses; some of them may be to find the capacity of a reservoir, to get the alignment of a road, to find the cut and fill volume etc.

Results:

Result may be a contour map of a given area.

Observation Table and Calculations:

Readings are to be noted down in field book in the table.

Check:

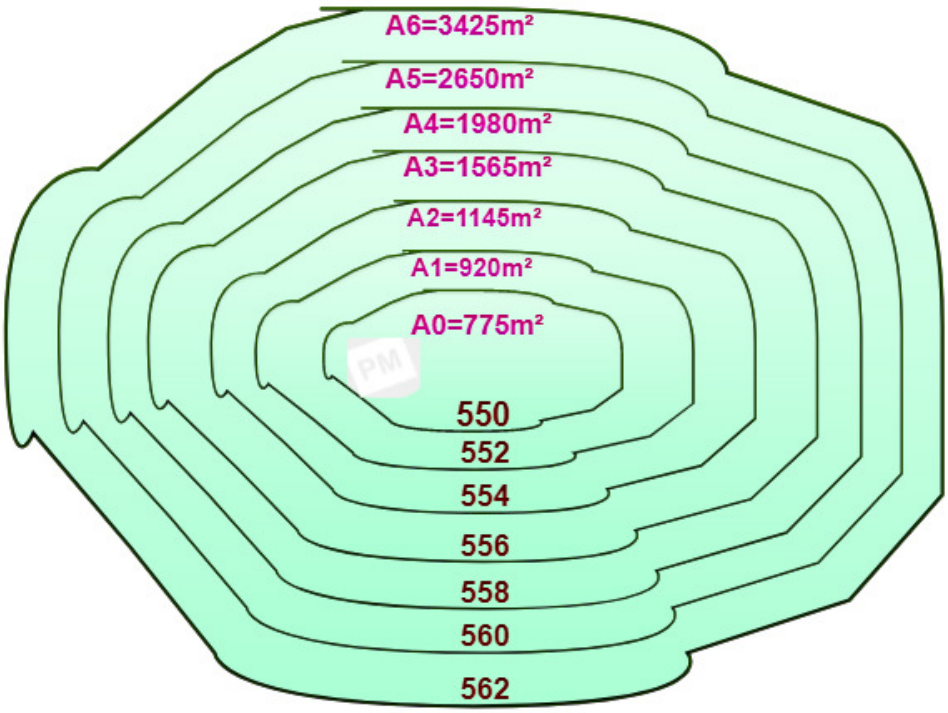
- Rise/Fall = F.S. / I.S. – B.S. = F.S. – I.S.
- RL of a station = BM/RL of previous station ± Rise/Fall

EXPERIMENT-14

OBJECT-To draw contour map of a small pond and to calculate its capacity.

Contours:

Imaginary lines joining all the points of equal elevation or altitude above mean sea level. They are also called “level lines”.



Contour map

Calculation:

The volume of water is calculated by using the trapezoidal & prismoidal formulas for contour maps. The answer will be nearer to accuracy & slightly differ from each other.

Now, let us calculate the volume of water by using both of them to observe the difference.

1. Trapezoidal formula:

The volume of water in the pond

$V = D \times [\{(A0 + An) \div 2\} + (A1 + A2 + A3 + \text{----} + An - 1)]$

Here,

D = Interval between the successive contours

A0 = area of 1st contour line = m^2

A1 = area of 2nd contour line = m

An = The area of the last contour = A6 =……m^2

(An - 1) = Prior to last contour = A5 = …….m^2

Now,

The volume of water in a pond

$V = D \times [\{(A0 + A6) \div 2\} + \{A1 + A2 + A3 + A4 + A5\}]$

V=…….m^3

2. Prismoidal formula:

The volume of water in the pond

V = D/3 [1st area + last area + 4 Σ even area + 2 Σ odd are]

$V = [(D \div 3) \times \{ (A0 + An) + 4 \times (A1 + A3 + A5) + 2 \times (A2 + A4)\}]$

V=……m^3

EXPERIMENT-15

OBJECT-To study a topo sheet of certain area and to mark on it water shed line and find out catchments area of a stream at a place.

Experiment no.-16

OBJECT: To study the accessories of plane table surveying and to plot the object by radial method.

INTRODUCTION TO PLANE TABLE:

Plane table surveying is a graphical method of surveying in which field work and plotting are done simultaneously in the field.

The plain table consists of the following:

1. Drawing board mounted on a tripod
2. Straight edge called an alidade.

THE DRAWING BOARD: The board is made of well-seasoned wood and varies in size from 40cm x 30 cm to 75cm x 60cm or 50 – 60 cm square.

The Alidade: The alidade consists of metal or box wood straight edge or ruler about 50cm long. The be welled edge of the alidade is called the fiducially edge.

Accessories to the plane table

1. Trough compass
2. U – frame or plumbing fork
3. Water proof cover.
4. Spirit level or level tube
5. Drawing sheet
6. Pencil or eraser

Trough compass: The compass is used to mark the direction of the meridian on the paper.

U-frame or Plumbing fork: U frame with a plumb bob used for centering the table.

Water Proof Cover: Water Proof cover protects the sheet from rain.

Spirit level or level tube: A level tube is used to level the plane table.

Drawing sheet: The drawing sheet is fixed on the top of the drawing board.

Pencil and eraser: A pencil is used for constructing lines and eraser is used for erasing lines after completion of the plan.

SETTING UP THE PLANE TABLE

The setting up the plane table includes the following three operations.

1. Centering the plane table
2. Leveling the plane table
3. Orientation of plane table

CENTERING THE PLANE TABLE:

The table should be set up at a convenient height for working say about 1m. The legs of tripod should be spread well apart and firmly fixed in to the ground. The table should be approximately leveled by tripod legs and judging by the eye.

Then the operation of centering is carried out by means of U-frame and plumb bob. The plane table is exactly placed over the ground station by U-frame and plumb bob.

LEVELING THE PLANE TABLE:

The process of leveling is carried out with the help of level tube. The bubble of level tube is brought to center in two directions, which are right angles to each other. This is achieved by moving legs.

ORIENTING THE TABLE:

The process of keeping the plane table always parallel to the position, which is occupied at the first station, is known as orientation. When the plane table is oriented, the lines on the board are parallel to the lines on the ground.

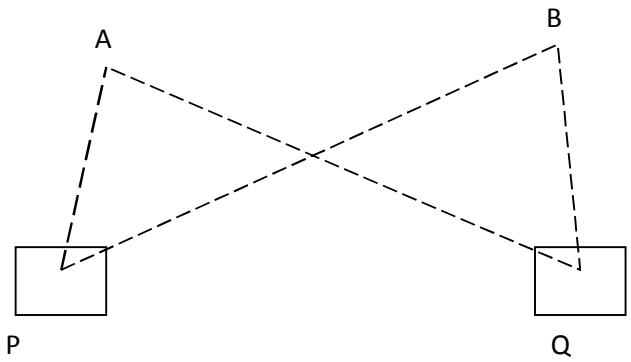
Experiment No. 17

OBJECT: To perform the plan table survey of small area by intersection method.

INSTRUMENTS:

1) Plane table
2) Tripod
3) Alidade

FIGURE



PROCEDURE:

1) Select two points P and Q such that the points (building corners) to be plotted are visible from their stations.
2) Set the table on P and locate on the sheet.
3) Pivot on P bisect Q draw a ray.
4) Measure the distance PQ and locate Q on the sheet to a convenient scale.
5) Now pq is known as the base line.
6) Pivot 'p' bisects the inaccessible objects A and B (building corners) and draw rays.
7) Shift the table to 'a' such that q is over Q and do temporary adjustments.
8) Place the alidade along qp and the rotate the table till p is bisected clamp table.
9) Pivot on q bisect the objects A and B and draw rays.
10) The instruction of rays drawn from P and Q will give the points a and b.
11) The same procedure is applied for other features of the campus. Each point is bisected from two stations.

Experiment No. 18

OBJECT: Study of minor instruments.

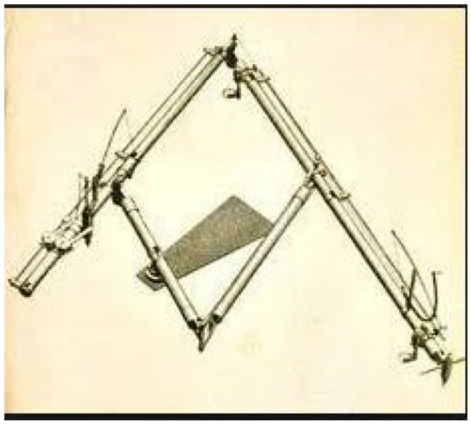
Hand Level: It is compact instrument used for locating contours, taking cross sections in reconnaissance surveys.

Clinometer: It is a light compact instrument used for measuring vertical angles, finding out slope of the ground and for locating points on a given grade. There are three commonly used forms of clinometers:

(i) Abney's level
(ii) Tangent Clinometer
(iii) Ceylon Ghat Tracer

Box Sextant:
It is a reflecting instrument capable of measuring up to 120 degrees with an accuracy of one minute. It is one of the most precise hand instrument.

Pantagraph: It is used to reduce or enlarge the given figure.



Planimeter: It is used to measure the area of the given figure.