

LECTURE

NOTES

ON

MINE SURVEY-1(3rd sem)

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MINING :-

An excavation made on the ground surface in, economically is called mining.

MINERAL :-

Mineral is a natural occurring homogenous inorganic substance have definite an composition an atomic structure which is economically called mineral.

ROCK :-

Aggregated of mineral is called rock.

ORE :-

Economical value of mineral is called ore.

GANJUE :-

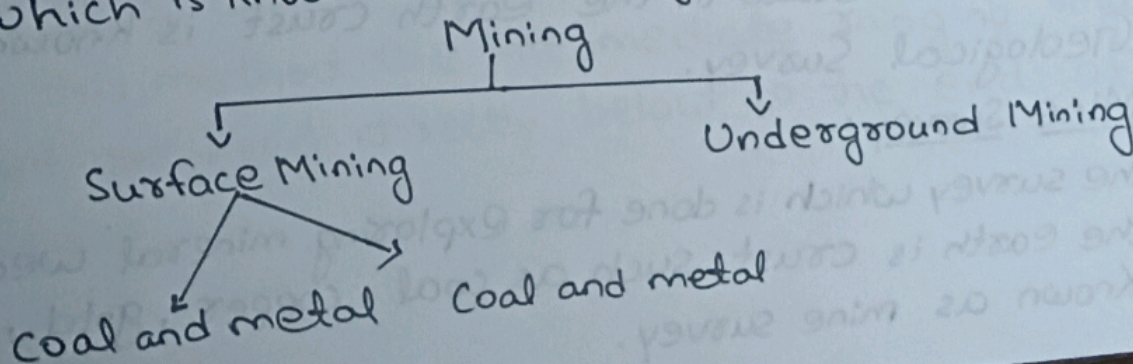
The mineral which has not economical variable associated with ore is called gangue.

OB → Over Burden (OB)

→ The material which is covered the mineral is called OB.

SURVEY :-

It is an act which determine the point or position in the earth surface by direct and indirect which is known as surveying.



PLANE :- Represented or Representation of map on a paper it is called plane.

What is the principle of survey :-

- To work whole part to a particular part,
- To fixed position of new station at list to independent process.

Classification of surveying method :-

Classification of surveying are two types :-

(i) Geodetic Surveying

(ii) Plane Surveying

(i) Geodetic Surveying :-

- In this method the earth curvature taken into account.
- The curvature is not constant.

(ii) Plane Surveying :-

- In this method the curvature of earth is not taken into account.
- The plane is constant.

Classification of surveying according to the object of surveying :-

(i) Geological Survey :-

The Survey which is conducted for determining different state in the earth crust is known as Geological Survey.

(ii) Mine Survey :-

The survey which is done for exploring mineral wealth under the earth is crust such as coal, copper, gold, etc is known as mine survey.

(iii) Military Survey :-

The survey which is conducted for determining the best position of attack and defence from military point of view, and also for finding out the best storage size for keeping ammunition is known as Military Survey.

(iv) Archaeological Survey :-

The survey which is done to trace out the relics of the past is known as Archaeological Survey.

(v) Engineering Survey :-

The survey which is conducted to collect data for carrying out any engineering project such as construction of road, railway, dam, water supply, etc is known as Engineering Survey.

Levelling :- It defined as the act of determination and representation of height or elevation of different object on the earth surface.

Ranging :-

Method of Ranging :-

There are two method in ranging -

- i) direct method
- ii) indirect method

i) Direct Method :-

In this method the intermediate ranging rod or point are fixed directly below to the end of to point.

ii) Indirect method :-

In this method the intermediate ranging rod can't be fixed directly and done by reciprocal ranging and an auxiliary line parallel to it.

Chain Surveying :-

Types of chain survey :-

Chain survey mainly are 3 types -

1) Gunter's chains (66' / 100 links)

2) Revenue chain (33' / 100 links)

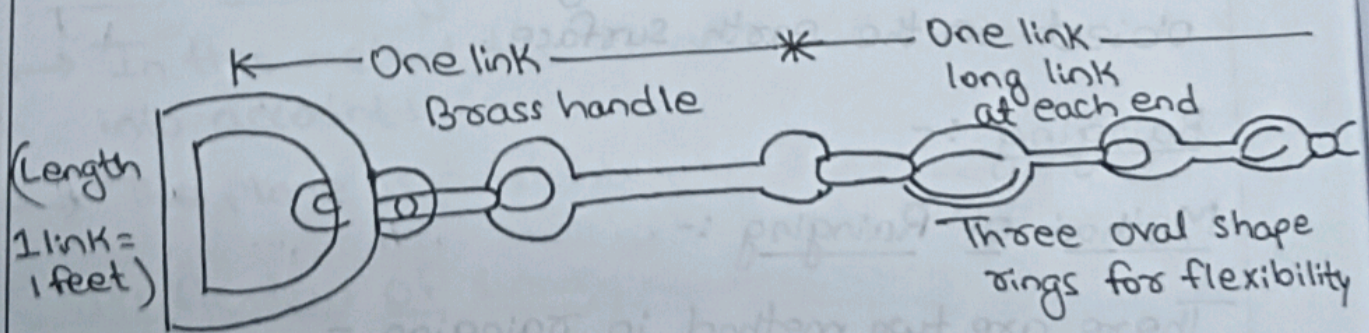
3) Engineer's chain (100' / 100 links)

* Errors Chain Surveying :-

It is mainly two types :-

(i) Compensating errors.

(ii) Cumulative errors.



(1) Compensating error :-

Compensating errors are those which can be in either direction of the line.

(2) Cumulative error :-

Cumulative errors are those which occur in the same direction and go on adding.

Obstacle chaining:-

These are mainly 3 types of obstacle chaining.

(1) Chaining free, vision / obstacle.

(2) Vision free, chaining obstruction.

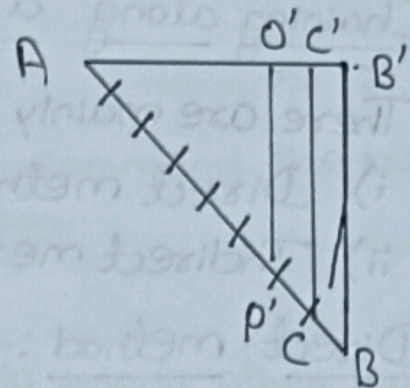
(3) Chaining and vision both obstruction.

1) Chaining free, vision obstruction:-

In the obstruction the chaining is free to measured length of the line but at the end point of line are not visible.

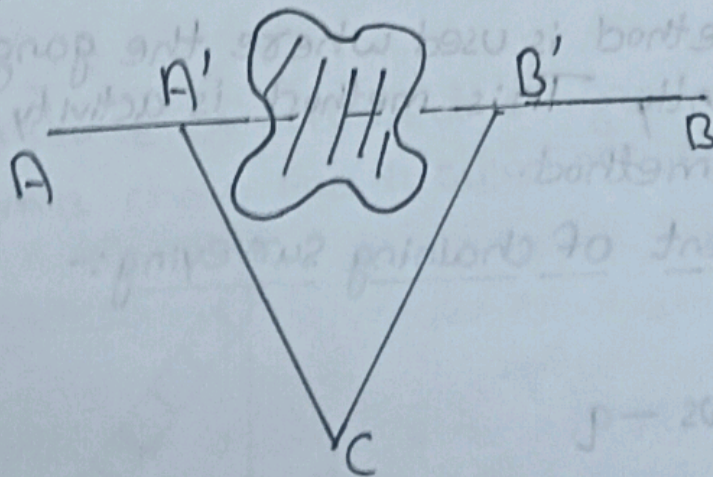
$$AB = \sqrt{(POB)^2 + (AB)^2}$$

$$h = \sqrt{p^2 + b^2}$$



2) Vision free, chaining obstruction:-

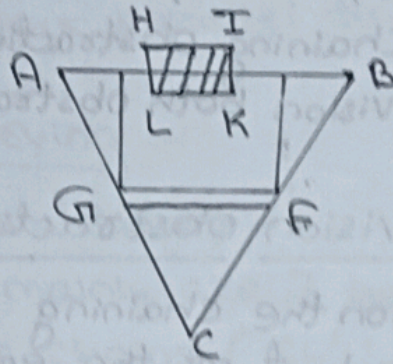
In this types of obstruction the vision is free but chaining is obstruction to measured the length of line.



$$A'B' = \sqrt{(A'C)^2 - (B'C)^2}$$

3) Chaining and vision are both obstruction:-

In this types of obstruction both, chaining and vision are obstruction.



* Chaining along a sloping ground:-

There are mainly 2 methods:-

- i) Direct method
- ii) Indirect method

i) Direct method:-

In this method is directly measured in the field by the method of sloping.

ii) Indirect method:-

This method is used where the gangue of slop is long and gently. This method is activity more than the direct method.

Instrument of chaining surveying:-

- 1) Chain
- 2) arrows - 9
- 3) tapes
- 4) Ranging rods
- 5) offsent
- 6) Crosstaffer optical square
- 7) Plumb
- 8) Peges
- 9) Wooden mallet

Purpose of chain surveying:-

- To locate to the boundary of a land.
- To determine the area of a pieces of a land.
- To divided the surveyed area into no. of unit.

Survey station:-

An important point of the chain line is called survey point or ending point of the line.

→ It mainly 2 Types:-

- Main station
- Subsidiary or tip station

i) Main station:-

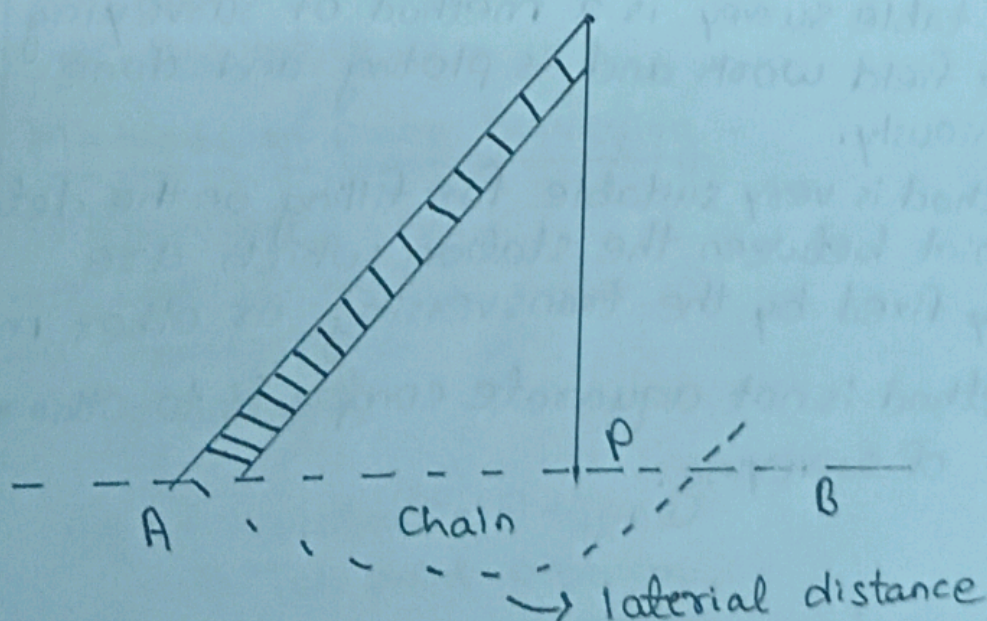
The end of survey line which command the boundary of survey are called main station.

ii) Subsidiary or tip station:-

Sometimes it will be necessary to select other points on the main survey line to run two line. Order to locate more interxial distance from the main lines. Such point are known as subsidiary or tip station.

Q) What is offsets?

Ans. The lateral distance of an object or ground features measured from a chain line is called offsets.



Perpendicular Offsets :-

When the angle offsets from a point on the chain line into 90° it is called perpendicular offsets.

Plane table Surveying :-

Define plane table survey :-

Plane table surveying is the graphical method survey in which the field observation and plotting proceed simultaneously.

Equipment of plane Surveying :-

- The plane table with tripod stand.
- Alidade
 sight compass
- Plumb bob
- Drawing paper and drawing equipment
- Spirit level

Principle of chain surveying :-

- The principle of chain surveying is best on symmetric and parallel.
- The plane table is considered to be a point of negligible dimension when compared to the area of survey.

Plane Table Survey :-

- A plane table survey is a method of surveying in which the field work and plotting are done simultaneously.
- The method is very suitable for filling in the details of the point between the station which are previously fixed by the traversing or other method.
- The method is not accurate compared to other method of surveying.

Advantages:-

- Plotting and field work are done simultaneously.
- It is very much suitable for small medium scale mapping.
- It is not accurate mapping.

Disadvantages:-

- It is an optical instrument or surveying method.
- It has lot of accessories so chances of loss in the field are high.
- It is very heavy and awkward to carry.
- Not suitable for large scale mapping.

Adjustment of plane Surveying:-

- The table should be set up at convenient height.
- The leg tripod should be spread well apart and firmly fixed in the ground.
- The table should be so placed that the station on ground that the point plotted on the sheet exactly at the station on the ground.
- The table is levelled by means of levelling screw with reference to the level tube or circular level placed on the table.

Methods of plane Surveying:-

- Radiation
- Intersection
- Traversing
- Resection

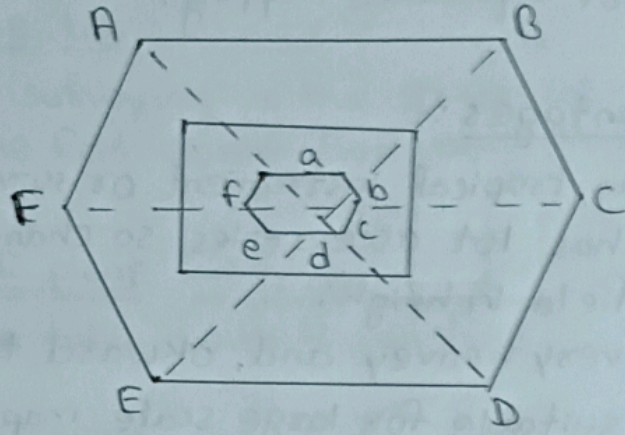


again resection is 2 types -

- Two point problem.
- Three point problem.

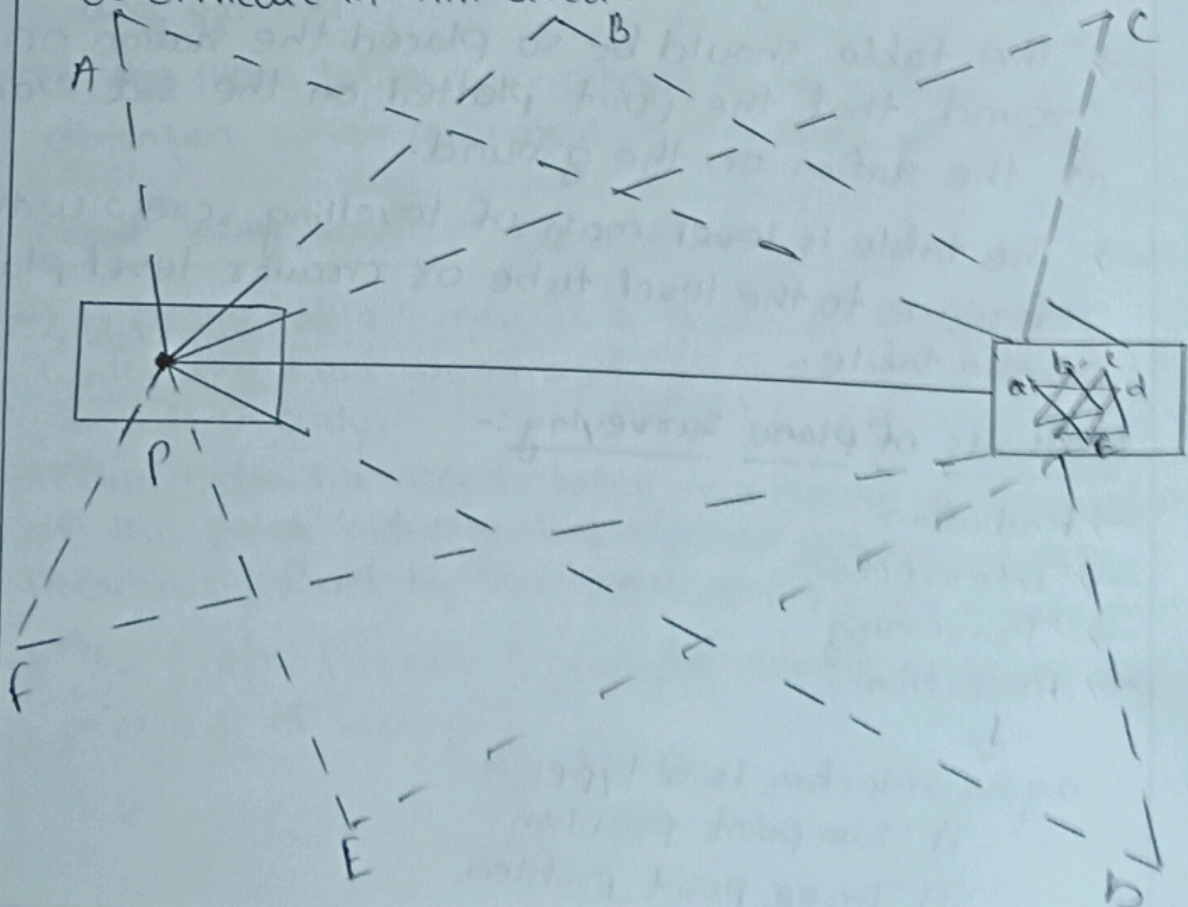
Radiation :-

In this method point is located on the plane by drawing a ranging from the plane table survey to the point and plotting to scale along the ray on the distance.



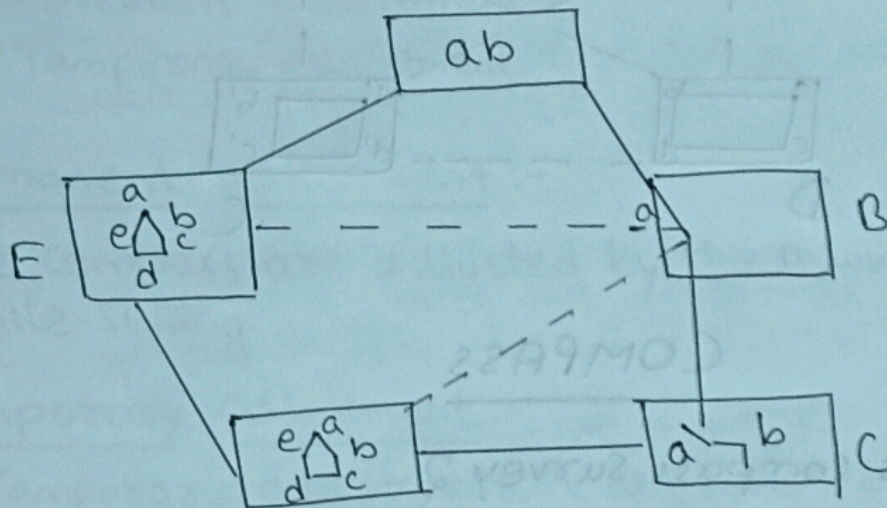
Intersection :-

In this method the point is fixed on the plane by intersection of the rays from the two instrument station the line joining two instrument station is known as base line. It is suitable for in normal surface and impossible or difficult in hill area.



Traversing:-

- This is method is similar to doct of compressor or frasiut traversing.
- It is used for running survey line between the instrument station which have been previously fixed by other method of surveying to locate the pagraphical detail. It is suitable for the survey of roads mine.

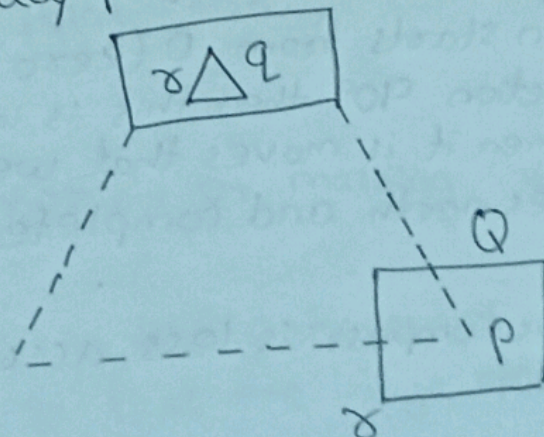


Rejection :-

- This method is used for fixing instrument station only after fixing the instrument station details are locate either by radiation or intersection.

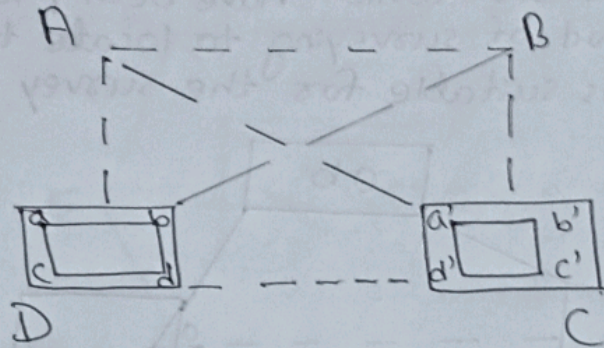
Two Point Problem:-

The two point problem consisting located on plane occupied by the plane table survey by means of observation to two well defined point, which are visible from the instrument station and which posisting having already platted on the plane.



Three Point Problem:-

The 3 point problem consists in locating on the plane by means by observation to three well defined point. Which are visible from the instrument plotted on the plane.



COMPASS

Q) What is compass survey?

Ans. The compass survey is used in deviation for many country to determine the direction. Compass are two types:-

- (i) Prismatic compass
- (ii) Surveyor's Compass

i) Prismatic Compass:-

→ It is a hollow circular box of 85-100mm Dia at the Centre which a balance magnetic.

→ Needle is pivoted the needle is boxed and carries an aluminium ring graduated degree and half degree.

→ The graduation starts from 0 (zero) to west east in clock wise direction 90° then this is increased towards south in 180° then it is moves that west direction 270° .

Then it is moves north and complete 360° complete round.

→ The prismatic compass is less accurate than the theodolite.

Method of Prismatic Compass:-

→ The compass may held in hand but for better accuracy it is mounted stands.

Adjustment :-

Adjustment are two types:-

i) Permanent adjustment

ii) Temporary adjustment

i) Permanent adjustment:-

The compass are adjusted by the manufacturer company while selling.

ii) Temporary adjustment:-

→ Temporary adjustment is are those which are temporary in nature.

→ In this types of adjustment all adjustments which are done before the stands on erect and the end of experiments.

→ It is further sub divided into three types -

i) Centering

ii) Levelling

iii) Focusing

i) Centering :-

It is the process of fixing the instrument exactly over the station point mark.

ii) Levelling :-

It is the method of marking the instrument properly level.

iii) Focusing :- It is the process of marking proper adjustment, so that the image appear on the objective glass.

Surveyor Compass:-

It is much used in land surveying purpose but now it is little used. It is generally similar gentle prismatic compass. Except it as another plane side a narrow vertical slit in a plain of the prism and carries and edge by needle.

Bearing :-

It is a horizontal angle which a line makes with a line of sum reference line or meridian.

Meridian :-

It is a reference line from where the bearing are taken. Meridian are divided three types -

- i) True Meridian
- ii) Magnetic Meridian
- iii) Orbital Meridian

i) True Meridian :-

- The point of intersection where the Earth axis and surface of earth is known as North and South Geographical pole.
- True meridian is a line passing through a point in the earth surface which is the line plane passing through given to the surface of pole.

ii) Magnetic Meridian :-

- It is a direction is indicated by a properly balanced magnetic needle free from local attraction.

iii) Orbital Meridian :-

It is the direction from survey station to defined station point or permanent object. It is also known as first line of survey.

Types of bearing :-

3 types of bearing

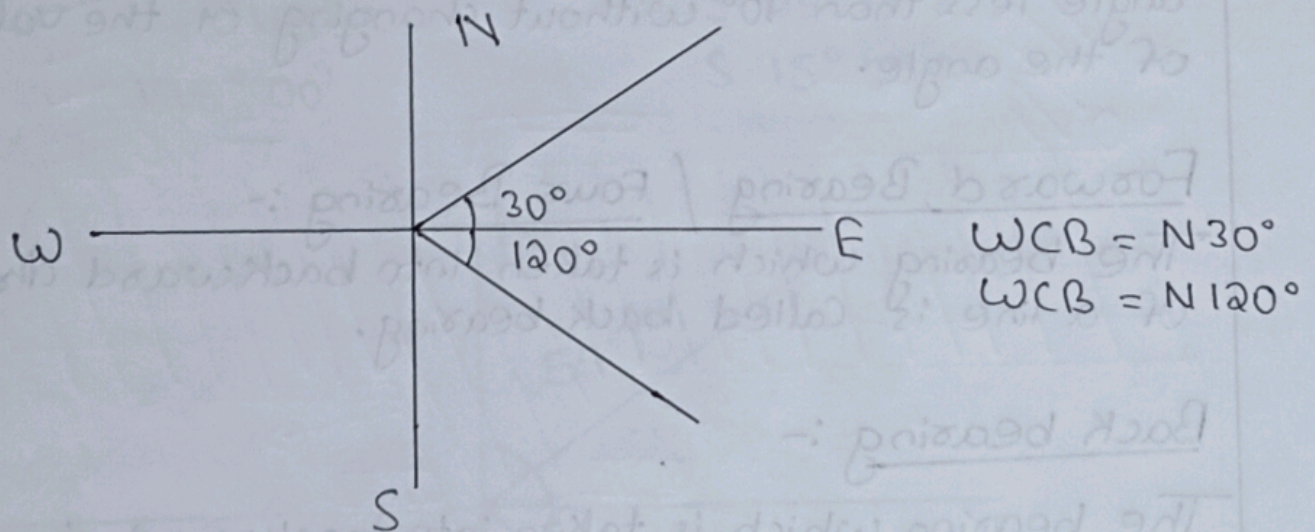
- (i) Whole circular bearing (WCB)
- (ii) quadrant bearing (QB)
- (iii) reduced bearing (RB)

i) WCB :-

In this system the bearing line measured clock wise direction. In reference to north pole point.

→ Value defers $0^\circ - 360^\circ$.

→ It is used in prismatic compass.



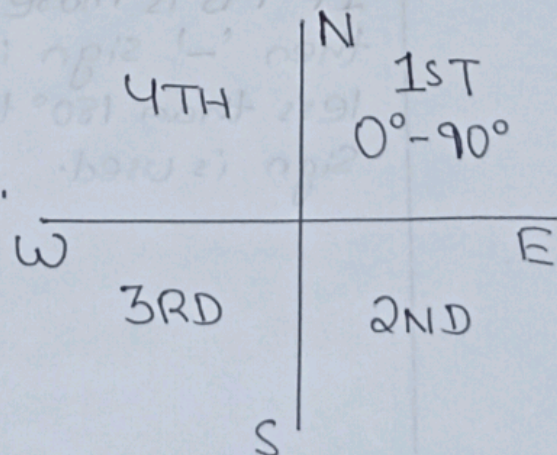
ii) QB :-

→ In this system the bearing line is measured from North end to south end.

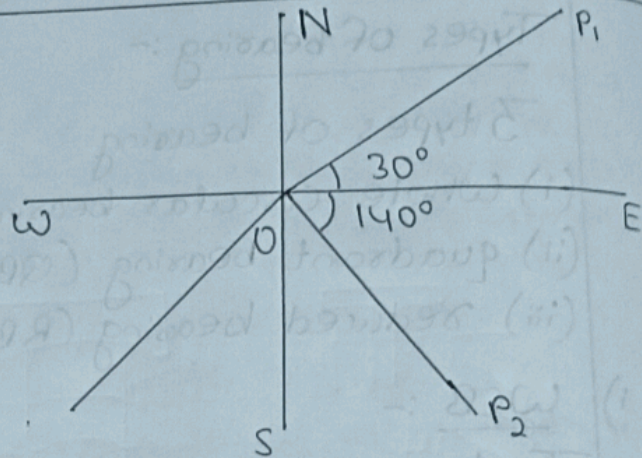
→ In clock wise direction.

→ It ranges to $0^\circ - 90^\circ$.

→ It is used in surveyor compass.



- 1) $WCB = 30^\circ$
- 2) $WCB = 140^\circ$
- 3) $WCB = 190^\circ$
- 4) $WCB = 290^\circ$
- 5) $WCB = 310^\circ$



Q)
Ans.

iii) RB :-

→ When the whole circle bearing line axis 90° , those it must be broad or reduced to a corresponding angle less than 90° without changing of the value of the angle.

Forward Bearing / Back Bearing :-

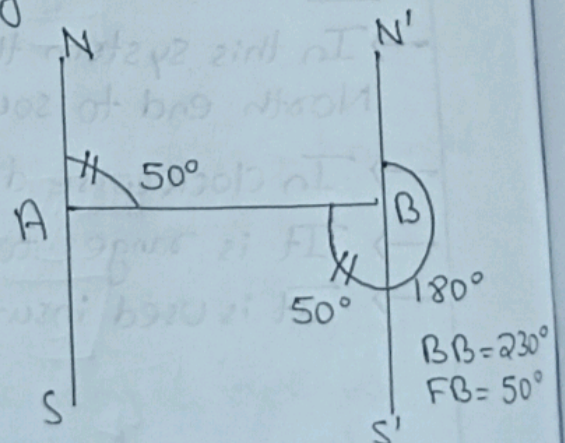
The bearing which is taken into backward direction of a line is called back bearing.

Back bearing :-

The bearing which is taken into backward direction of a line is called back bearing.

$$FB \pm 180^\circ$$

If FB is more than 180° then '-' sign is used if less than 180° then '+' sign is used.



Q) Define Contours:-

Ans. Contour is an imaginary line joining the two point in the same Elevation.

Local attraction :- / alteration :-

If the magnetic needle doesn't point toward the magnetic north under the influence of sum external alteration force such external attractive force is known as local attraction.

WCB

$55^{\circ}15'$

$143^{\circ}45'$

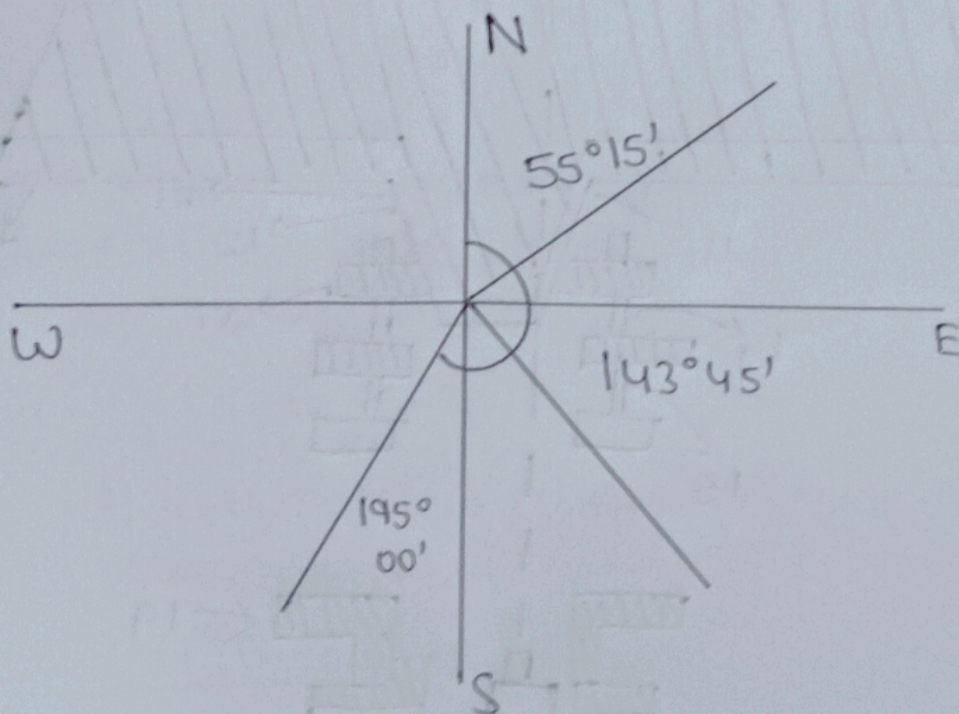
$195^{\circ}00'$

QB

N $55^{\circ}15'$ E

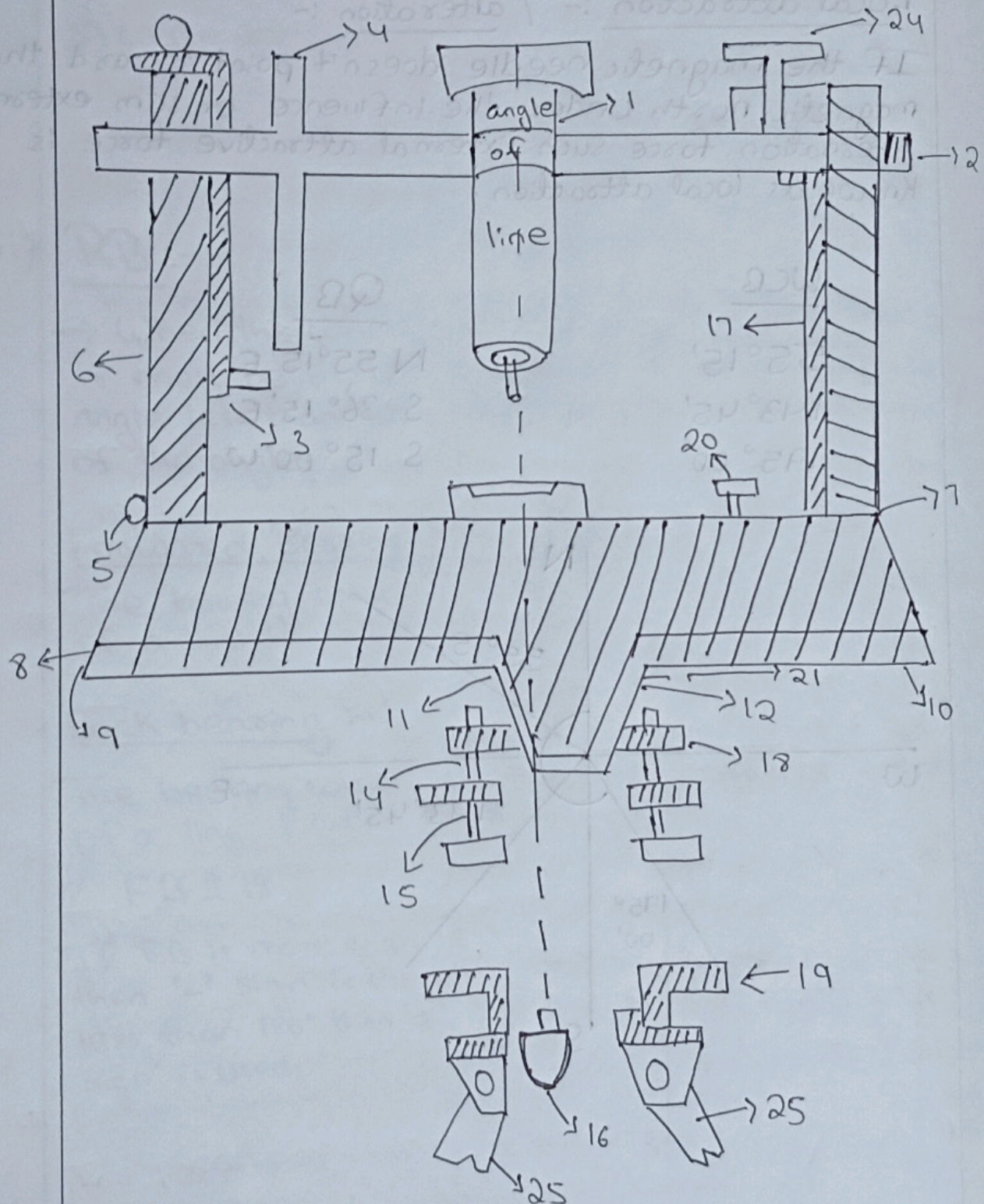
S $36^{\circ}15'$ E

S $15^{\circ}00'$ W



Theodolite

What is Theodolite :-



- 1) Telescope
- 2) Trunnion axis
- 3) Vernier frame
- 4) Vertical Circle
- 5) Plate level
- 6) Standards (FM)
- 7) Upper Plate
- 8) Horizontal Plate Vernier
- 9) Horizontal Circle
- 10) Lower Circle
- 11) Inner Axis
- 12) Outer Axis
- 13) Altitude level
- 14) Levelling head
- 15) Levelling Screw
- 16) Plumb bob
- 17) Vertical Circle Clamp
- 18) Foot Plate
- 19) Tripod head
- 20) Upper Clamp
- 21) Lower Clamp
- 22) Vertical Circle Clamp
- 23) Tripod Stand

Q) What is Theodolite :-

Ans. The theodolite is the most specious instrument designed for the measurement of horizontal and vertical angle.

→ It is most widely used in surveying instrument.

→ Theodolite may be classified into 2 Types →

- i) Transit Theodolite
- ii) Non Transit Theodolite

i) Transist Theodolite :-

It is one which its line of sight can be reversed by revolving the telescope through 180° in vertical plane.

ii) Non - Transist Theodolite :-

The non transist theodolite are either plane theodolite or y - theodolite in which the telescope cannot transist.

* Vertical axis :-

The vertical axis is the axis about which the instrument are rotated in a horizontal plane.

* Horizontal axis :-

The horizontal axis is the axis about which the telescope and the vertical circle rotating in vertical plane.

* The line of sight or line of culmination :-

It is the line passing through the intersection of horizontal and vertical cross hairs and optical centre of object glass and its continuation.

* Axis of level tube :-

The axis of level tube or bubble line is a straight line tangent to a longitudinal curve of a level tube at its centre. The axis of the level tube is horizontal when the bubble is in center.

* Centering :-

The process of setting of theodolite exactly over the station mark it is known as centering.

* Swinging of telescope :-

It is the process of running the telescope in horizontal plane. If the telescope is rotated in clock wise direction then it is known as right swinging. If the telescope is rotated in Anti clock wise direction. It is known as left swinging.

Theodolite (Permanent adjustment)

The permanent adjustment of theodolite are made to establish fixed the relationship between instruments fundamental lines.

Permanent adjustments are :-

- Vertical axis.
- Horizontal axis.
- Axis of plate levels.
- Axis of telescope.
- Bubbles water should read zero.

Adjustment of theodolite :-

There are mainly two types of theodolite.

- i) Temporary adjustment
- ii) Permanent adjustment

i) Temporary adjustment :-

→ Temporary adjustment or station adjustment are those which are made at every instrument setting and preparatory or taking observation with the instrument.

→ The temporary adjustments are

- a) Setting over the station.
- b) Leveling up.
- c) Elimination parallel.

Compass

Prismatic Compass

- Graduation circle is fixed to base type needle hence. It will not rotate with the line of sight.
- There is a prism at viewing end.
- Sighting and reading can be done simultaneously.
- The magnetic needle does not act as an index.
- The graduation are in whole circle bearing.
- Graduation are marked inverted since its reflection is read through prism.
- Tripod may or may not be used. It can be held on a stretched hand also.

Surveyors Compass

Graduation circle is fixed to the box hence rotated with the line of sight.

At viewing end there is no prism. There is only a slit.

Sighting and viewing cannot be done simultaneously.

Magnetic needle acts as index

While reading, the graduation are quadrantal system.

Graduation are marked directly the viewing from top glass.

Tripod is essential for using it.

Sources of error in theodolite :-

Sources of error about three types

- (i) Personal error
- (ii) Instrumental error
- (iii) Natural error

i) Personal errors :-

→ The errors which occur due to personal fault of the surveyor or insufficient knowledge of survey of surveyors are known as personal errors.

ii) Instrumental errors :-

→ The instrumental errors are due to imperfect adjustment of instruments.

→ Structural defect in the instruments

→ Imperfection due to wear.

iii) Natural errors :-

→ Unequal atmospheric refraction due to high temperature

→ Unequal expansion of parts of telescope and circle due to temperature changes.

→ Unequal settling in the tripod.

→ Wind producing vibration.

Compass :-

Correction of local Attraction:-

Line	FB	BB
AB	$45^{\circ}45'$	$236^{\circ}10'$
BC	$96^{\circ}55'$	$277^{\circ}5'$
CD	$29^{\circ}45'$	$209^{\circ}10'$
DE	$324^{\circ}48'$	$144^{\circ}48'$

Line	LA	Error	Correction
AB	✓	+25	-25
BC	✓	+10	-10
CD	✓	-35	+35
DE	X	0	0

Line	Observed bearing	Correction bearing	Remark
AB	$45^{\circ}45'$	0	$45^{\circ}45'$
BA	$226^{\circ}10'$	-25'	$225^{\circ}45'$
BC	$96^{\circ}55'$	-25'	$96^{\circ}30'$
CB	$277^{\circ}5'$	-35'	$276^{\circ}30'$
CD	$29^{\circ}45'$	-35°	$29^{\circ}10'$ Point
DC	$209^{\circ}10'$	0	$209^{\circ}10'$ 'B'
DE	$324^{\circ}48'$	0	$324^{\circ}48'$ and 'C'
ED	$144^{\circ}48'$	0	$144^{\circ}48'$

Measurement of horizontal angle by theodolite
are mainly two types:-

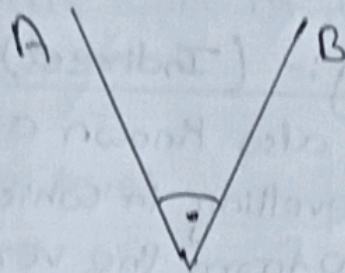
(i) Repetition method

(ii) Reiteration method

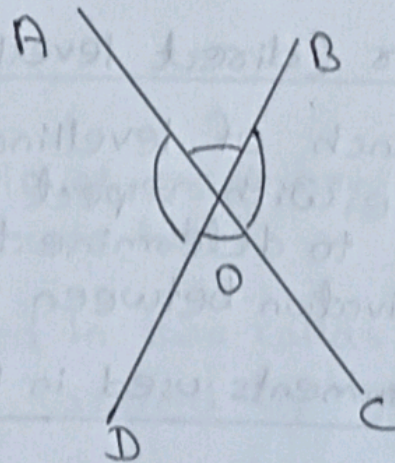
(i) Repetition Method :- ($0^\circ - 180^\circ$)

→ Set the instrument at 'O' the level it with the help of upper screw clamp and tangents set 'O' reading of vernier 'A' and 'B' vernier reading.

→ Loosen the lower clamp and direct the telescope towards point 'A' and clamp the low clamp and bisect the point 'A' by lower tangent screw.



Reiteration Method :-



(Levelling)

Defined levelling :-

Levelling is the process of finding the differences in vertical height between two or more points in the earth surface.

Method of levelling:-

Method of levelling is mainly 3 type :-

- 1) Barometric levelling
- 2) Trigonometric levelling (Indirect levelling)
- 3) Spirit levelling (direct)

1) Barometric levelling:-

- Barometric levelling makes use of the phenomenon that difference in elevation between two points is proportional to the difference in atmospheric pressure.
- Barometric level are used for reading observed at different points and elevation of different points.

2) Trigonometric levelling:- (Indirect)

- Trigonometric levelling also known as indirect levelling.
- Is the process of levelling in which the elevation of points completed to form the vertical angle and horizontal distances measured in the field.

3) Spirit levelling or (direct levelling):-

- It is that branch of levelling in which the vertical distance with respect to the horizontal line may be used to determine the relative difference in elevation between two adjacent points.

What are the instruments used in levelling:-

- 1) A level
- 2) A levelling staff

1) A level :-

The purpose of level is to provide a horizontal line of a site.

→ A level is consist of four parts -

- i) A telescope to provide a line of site.
- ii) A level tube to make the line of site horizontal.
- iii) A levelling head to bring the bobbles in its center of sun.
- iv) A tripod to support the instruments.

Types of level :-

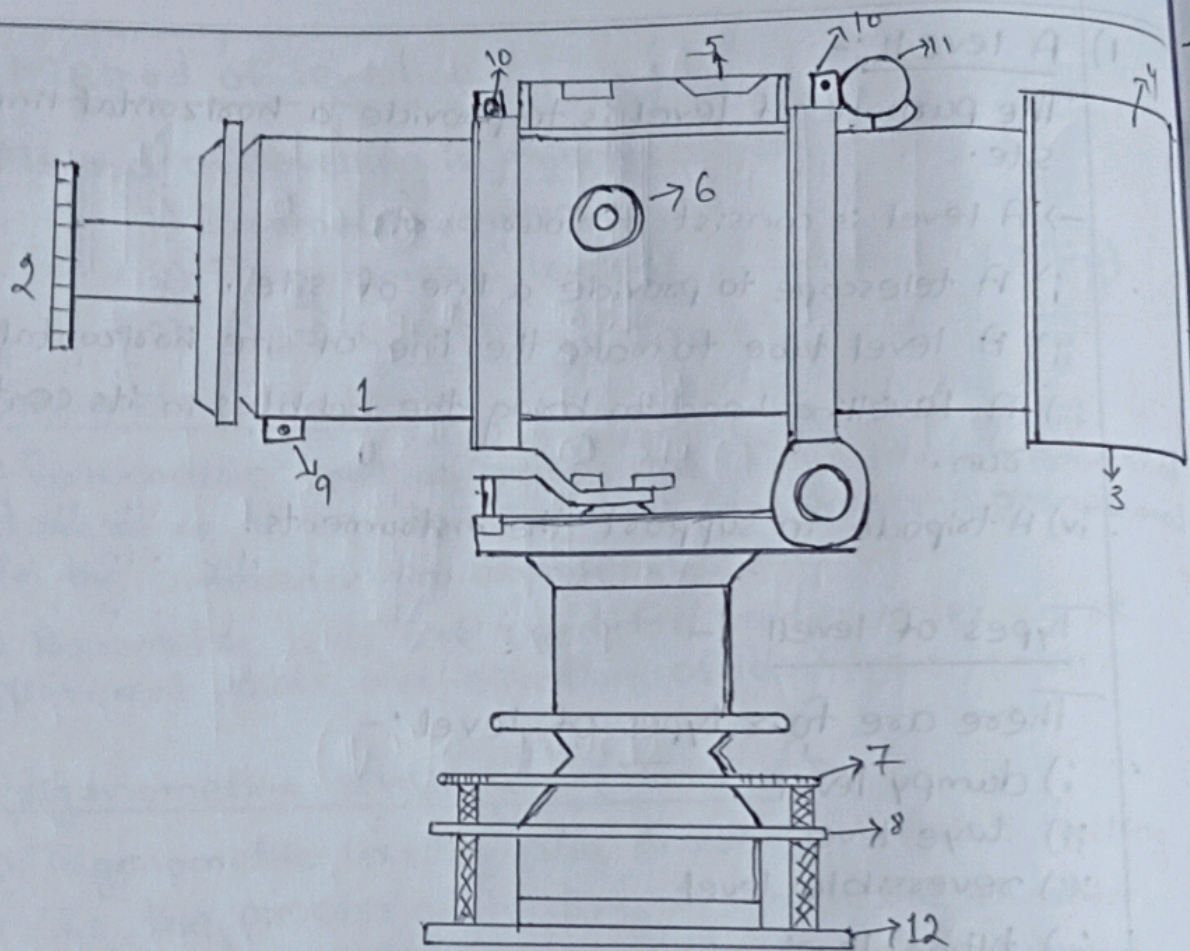
There are four types of level :-

- i) dumpy level
- ii) Wye level
- iii) reversible level
- iv) tilting level
- v) lop level
- vi) Auto level

i) Dumpy level :-

→ The dumpy level originary designed by gravatt consist of telescope tube.

→ firmly secured in two collar fixed by adjusting to the stage carried by the vertical spindle.



(DUMPY LEVEL)

- 1) Telescope
- 2) Eye piece
- 3) Rayshade
- 4) Objective end
- 5) Longitudinal bubbles
- 6) Focusing screws
- 7) Foot screws
- 8) Upper Parallel plate
- 9) Diaphragm adjustment screws
- 10) Bubbles tube adjusting screw
- 11) Traverse bubbles tube
- 12) Foot Plate

→ The modern form of dumpy level has the telescope tube and the vertically spindle cast in one piece and a long bubble tube is attached to the top of the telescope. This form is known as solid dumpy.

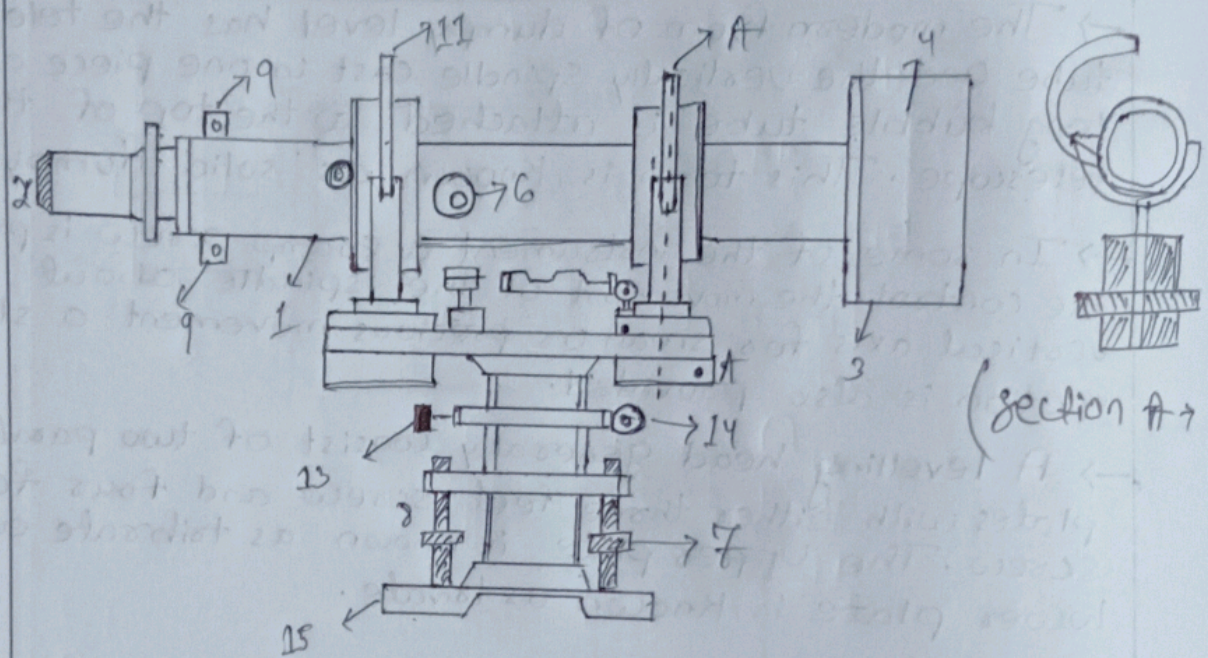
→ In some of the instrument a clamp screw is provide the control the movement of the spindle about vertical axis for small or precious movement a slow motion is also provided.

→ A levelling head generally consist of two parallel plates with either three feet screw and four feet screw. The upper plate is known as tribrach and lower plate is known as tribrach.

11) Wye Level :-

→ The assential between dumpy level and wye level is that in the former case the telescope is fixed in spindle while in wye level, the telescope is carrying into vertical wye support.

→ The wye support consist of curved clips if the clips are raised, telescope can be rotated in the wyes or removed and termed and for end.



(Wye Level)

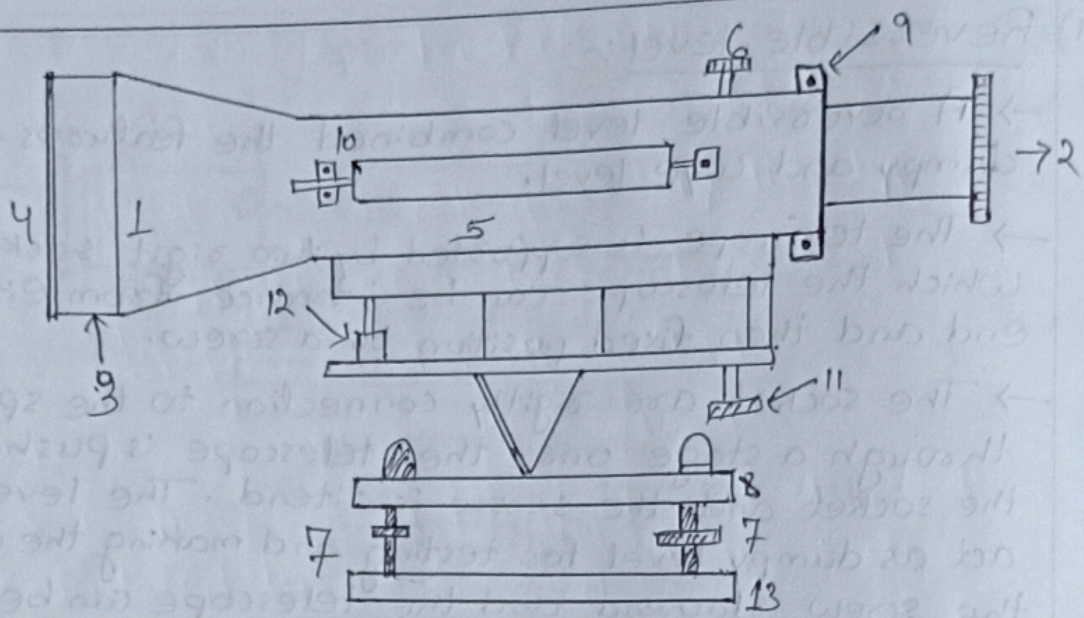
- 1) Telescope
- 2) Eye piece
- 3) Rayshade
- 4) Objective end
- 5) Bubble tube
- 6) Focusing Screw
- 7) Foot Screw
- 8) Trivet
- 9) Diaphragm adjusting Screw
- 10) Bubble tube adjusting
- 11) Wye Clipe
- 12) Clipe half upon
- 13) Clamp Screw
- 14) Tangent Screw
- 15) Trivet

(III) Reversible level:-

- A reversible level combined the features of both dumpy and wye level.
- The telescope is supported by two rigid socket into which the telescope can be introduced from either end and then fixed position by a screw.
- The socket are rigidly connection to the spindle through a stage once the telescope is pushed into the socket and the screw is tightened. The level act as dumpy level for testing and making the adjustment the screw slackened and the telescope can be taken out and reversed and for end.
- The telescope can also turned within the socket about the longitudinal axis.

(IV) Tilting Level:-

- In the case of dumpy level and wye level the line of site is perpendicular to the vertical axis.
- Once the instrument is leveled, the line of site becomes horizontal and vertical axis truly become vertical.
- In the case of tilting level, however line of site can be tilted slightly without tilting the vertical axis. Thus the line of site in the vertical axis need not to be exactly perpendicular to each other.
- The instrument is leveled roughly by the three foot screw with respect either to the bubble tube or to a small circular bubble.



- 1) Telescope
- 2) Eye piece
- 3) Ray shade
- 4) Objective end
- 5) Level tube
- 6) Focusing screws
- 7) Foot screws
- 8) TRIBRACH
- 9) Diaphragm adjusting

ERROR IN LEVELING :-

Errors of levelling are mainly three types:-

- 1) Instrument error
- 2) Natural error
- 3) Personal error

1) Again instrumental errors are five types:-

- i) Error due to imperfect adjustment.
- ii) Error due to sluggish bubbles.
- iii) Error due to movement objective slide.
- iv) rod not standard length.
- v) error due to defective joints.

Natural Errors:-

2) Again Natural Errors are five types:-

- i) Earth curvature.
- ii) atmospheric refraction.
- iii) various temperature.
- iv) Settlement of tripod on turning point.
- v) Wind vibration.

Personal Errors:-

3) Again personal errors are five types:-

- i) mistake in manipulation.
- ii) rod handling.
- iii) error in sighting.
- iv) mistake in reading.
- v) mistake in recording and computing.

REDUCING

METHODS OF REDUCING LEVELLING

→ Reducing levelling mainly two types:-

- i) Height of instrument method
- ii) Rise and Fall method

i) Height of instrument method:-

→ In this method the height of instrument is calculated for each setting of the instrument. By adding back sight to the elevation of the first point.

→ The elevation of Reduce level of the turning point is then calculating by subtracting from HI of the fore sight (Minor sight).

→ For the next setting of instrument, The HI is Obtained by adding the back sight on total point.

→ If there are some intermediate point, The reduce level of those points is calculated by subtracting the intermediate sight (minor sight) from the H.I for that setting.

→ The different between the sum of back sight and the sum of fore sight should be equal to the different between the last and the first Reduce level are equal to -

$$\sum B.S - \sum F.S = \text{Last Reduce level} - \text{First Reduce level}$$

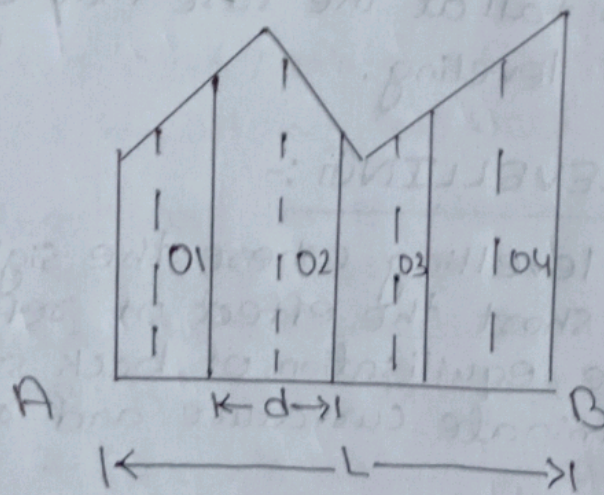
COMPUTATION OF AREA

* Computation of areas are mainly determined the following rules:-

- i) Mid point ordinate rule.
- ii) Average ordinate rule.
- iii) Trapezoidal rule.
- iv) Simpson's rule.
- v) Graphical rule.

i) Mid point ordinate rule:-

→ The rule state that if the sum of all the ordinates taken at mid point of each division multiplied by the length of the base line having the ordinates (line divided by number of equal parts).



→ In this base line AB is divided into equal parts and the ordinates are measured in the mid point of each division.

$$\text{Area} = \frac{[O1 + O2 + O3 + O4] \times L}{n}$$

Where

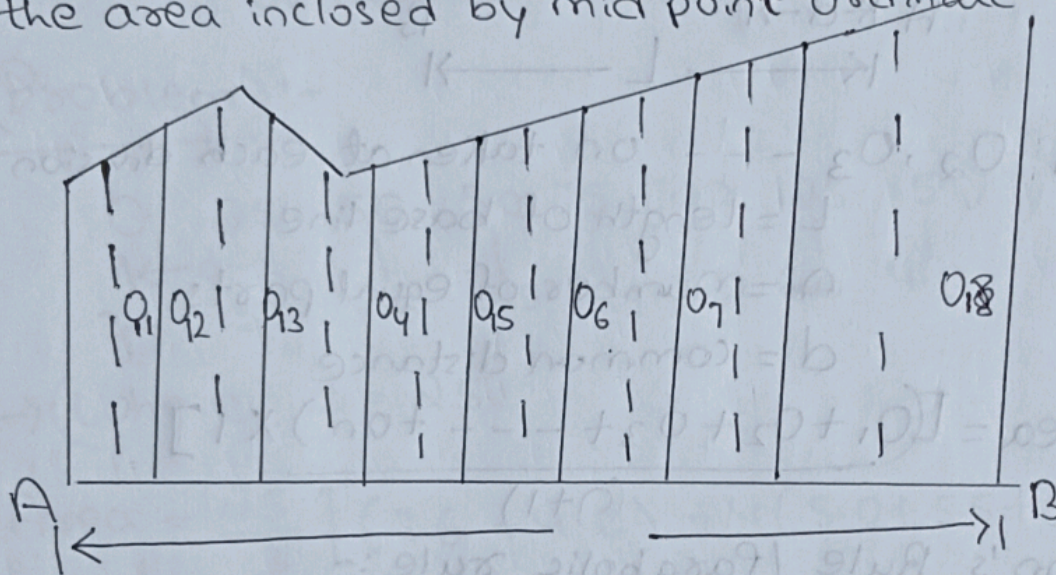
L = Length of base line

n = number of equal parts

d = common distance between the ordinary

Problem-1

The following perpendicular offset were taken at 10m interval of survey line to an irregular boundary line, the ordinates are measured at mid point of division are 10, 13, 17, 16, 19, 21, 20 and 18 m. Calculate the area inclosed by mid point ordinate rule.



$$\text{Area} = \frac{[O_1 + O_2 + O_3 + O_4 + O_5 + O_6 + O_7 + O_8] \times L}{n}$$

$$= \frac{[10 + 13 + 17 + 16 + 19 + 21 + 20 + 18] \times L}{8}$$

$$= \frac{134 \times 80}{8}$$

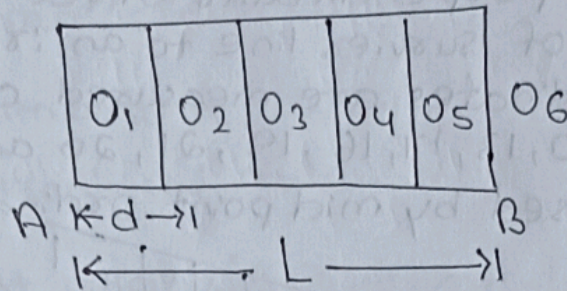
$$= \frac{10720}{8}$$

$$= 1340 \text{ m}^2 \text{ (Ans)}$$

$$\left(\begin{array}{l} d = 10, n = 8 \\ L = d \times n \end{array} \right. \quad \left. \begin{array}{l} 10 \times 8 \\ = 80 \end{array} \right)$$

ii) Average Ordinate rule:-

→ The rule state that :- to the average of all the ordinates taken at each division of equal length multiplies by baseline length divided number of ordinates.



→ $O_1, O_2, O_3, \dots, O_n$ taken at each division
 L = length of base line
 n = number of equal parts
 d = common distance

$$\text{Area} = \frac{(O_1 + O_2 + O_3 + \dots + O_n) \times L}{(n+1)}$$

iii) Simson's Rule / Parabolic rule:-

The rule state that sum of first and last ordinate has to be done.

→ Add twice the sum of remaining odd coordinate and four time the sum of remaining even ordinate then multiply the total sum by $1/3$ third of the common distance from the ordinate which gives the required area.

→ Where $O_1, O_2, O_3, \dots, O_n$ are the length of the ordinate.

d = common distance

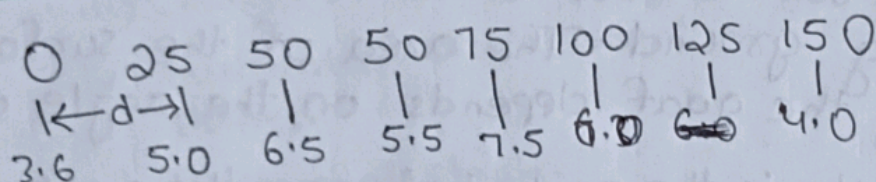
n = number of division

→ If the number of ordinates are even the area of last division may be calculated separately and added to the result obtained by applying Simpson's rule to remaining ordinates.

→ Even the first and last ordinates happens to be 0, they are not to be omitted from Simpson's rule.

$$\text{Area} = \frac{d}{3} \left[(\text{First ordinate} + \text{last ordinate}) + 4(\text{Sum of even ordinate}) + 2(\text{sum of odd ordinate}) \right]$$

(Problem):-



→ (Where) $d = 25$

$$\begin{aligned} \text{Area} &= \frac{25}{3} \left[(3.6 + 4.0) + 4(5.0 + 5.5 + 6.0) + 2(6.5 + 7.5) \right] \\ &= 842.99 \text{ m}^2 \end{aligned}$$

iv) Trapezoidal rule :-

→ In this method boundary between the end of ordinates are assumed to be straight line thus the area between these lines and the irregular boundary line are considered as a trapezoidal.

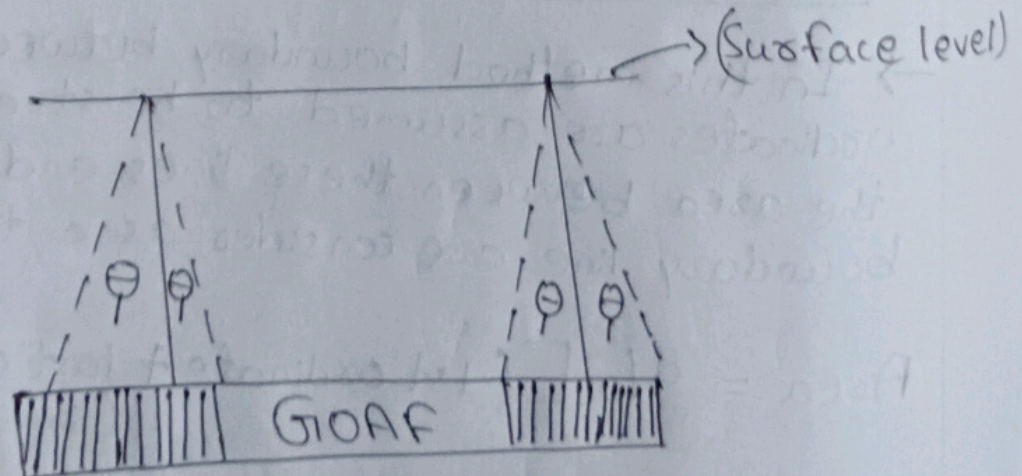
$$\text{Area} = d/2 \left[(\text{1st ordinate} + \text{last ordinate}) + 2(\text{sum of other ordinates}) \right]$$

(Levelling)

(used underground)

Subsidence Levelling :-

- The term subsidence means the lowering of the surface.
- When an underground opening is established due to extraction of a coal or ore body.
- The original equilibrium of strata is disturbed with resultant stress concentration.
- It causes effect on the surface where particle suffers vertical and horizontal displacement, creating subsidence basin or trough which flared out to sides until it is level with the existing ground. The area of the surface affected above the goaf depends on the angle of draw.
- Which is the angle between the vertical line from a edge of the goaf and a line extended to a point at which the subsidence tapers out to zero.
- The angle of ^{draw} varies with depth, nature and inclination of the strata and other geological features.



AIM OF Subsidence Levelling :-

→ If ground movement observation are carried out in a scientific manner, deparing operation and observation data are kept properly maintained, many valuable information such as amount of subsidence its can be made available for planing feature operation under similar ground condition and similar operational parameter.

→ The five parameter of subsedence are :-

- i) Vertical subsedence.
- ii) Differential change in ground slope.
- iii) Change in the surface curvature.
- iv) Horizontal displacement of different surface points.
- v) Horizontal strain.

Trigonometrice Levelling :-

→ When inclined distance between two points is known as relative altitudes and the horizontal displacement of the point may be determined by the reading with the vertical circle of the theodolite the angle of a depression of the line joining the points.

→ This method of finding altitudes is known as trigonometrice levelling. This method is suitable in steep gradients where the dumpy level is in conveniente to sets and where extreme accuracy is not required only and approximate difference in level between two points is urgently required.

Advantages of trigonometric levelling :-

- It is important in under ground working of seam inclined at 10° to 12° upwards, where the use ordinary level would be inconvenient by reason of the shortness of sides for restricted height.
- This method of levelling is suitable for levelling hilly and mountainous region where ordinary leveling with dumpy level is difficult and time taking.
- It is preferred for levelling for steep gradients and when distance involved is large.
- The consumption with stadia measurement this method is used for contouring in hilly area.
- As the inclined length is measured along the slope any error measurement due to can be avoided.

Disadvantages :-

- The degree of accuracy attainable by this method is low and comparison to the attainable by leveling with a dumpy level the permissible error for trigonometric levelling is 1.5 cm per 1 km of run and for ordinary levelling with a dumpy level it is 0.15 cm per 1 km of run.

→ Profile of the ground may not be parallel with the inclined line of sight the linear measurement along the ground in such cases can never be equal to the inclined distance.

→ The accuracy is entirely depends the linear measurement, vertical angles and the ground profile.

→ The method is preferred only when extremely accuracy is not equal.

Contour :-

Contour is an imaginary line joining the two points in the same elevation from the mean level.

Contour interval :-

The vertical distance between any two consecutive contours is called contour interval.

Characteristics of contour :-

Geometric levelling :

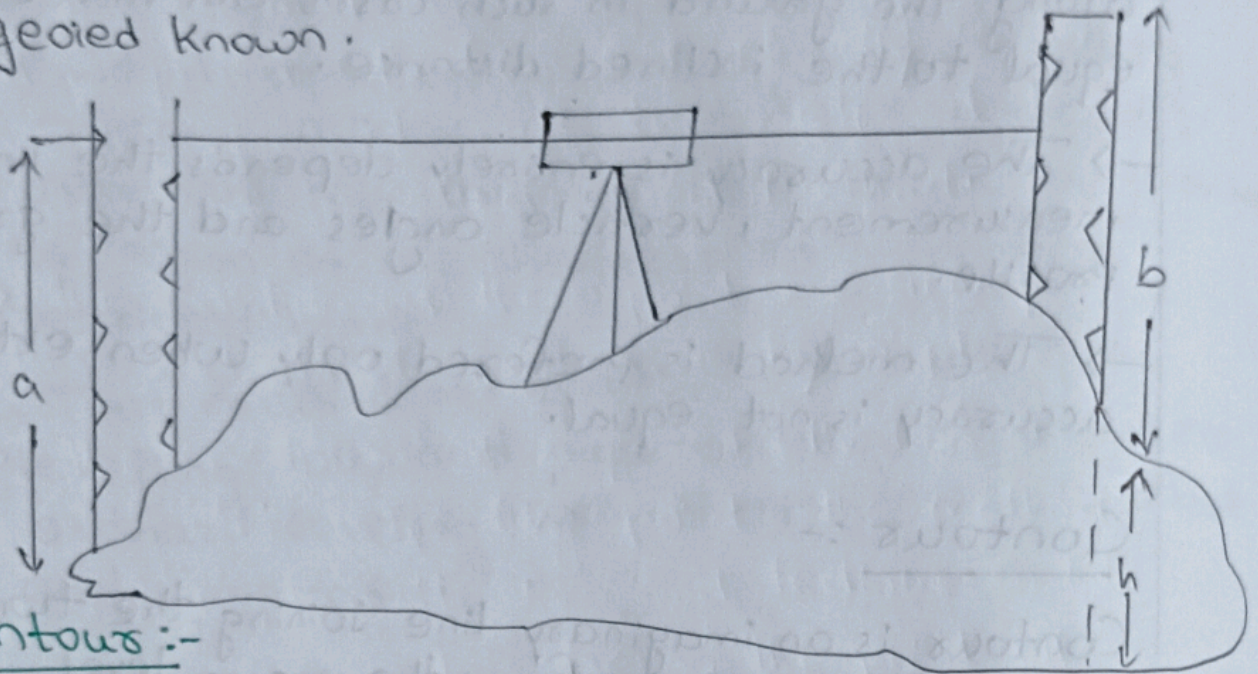
→ Geometric levelling is a set of operating procedure to measure the difference in level between two points.

→ That is the difference height between two points in the earth surface.

→ Geometric levelling defects from trigonometric levelling in the taking of the measurement is independent of distances.

→ Geometric levelling is performed to determine the absolute elevation of a point for which only the difference between the level and that of another point is known.

→ It needs to be link to a levelling bench marks points which absolute position is reference to the geoid known.



Contours :-

Contours is an imaginary line joining the two point in the same elevation from the means level.

Contours interval :-

The vertical distance between any two consecutive contours is called contour interval.

Characteristics of contours :-

⇒ All point in one contour line have the same reduce level (RL).



→ Every contour line closes on its self either within or bind the limit of Map.

→ Contours line are equally spaced when the ground is an formly sloping and where the ground is plane these straight and parallel.

- Contour never split nor do contours nor closed crossed each other except in the case distance of an over hanging cliff.
- Contour line crossed edge line or valley line at right angle.
- A series of closed contours on the map indicates a depression or a summit according as the lower the higher value are inside them.
- The direction of the steepest slope at a point contour is at right angle to the contour.

(CALCULATION OF ORE RESERVE)

Classify ore reserve:-

- Ore reserve are mainly two types:-

1) Proved reserve:-

Economical minable part of measured resource is known as proved reserve.

2) Probable reserve:-

Economical minable part of indicated resource (measured under particular circumstances) is known as probable reserve.

Evaluate reserve by explanatory:-

(contour)

Methods of contouring:-

- Methods of contouring are mainly two type-

1) Direct Method

2) Indirect Method

I) Direct Method :-

- The method in which contouring of the point of required elevation are directly located on the ground with the help of leveling instrument is called direct method.
- The position of these points are surveyed by chain and offsets method or by a plane table.
- The contours of required elevation are drawn joining the respective points. The method is accurate but it is slow and tedious as a lot of time is consumed in finding the point of same elevation on the ground.
- Contouring by direct method is done by any of the following methods:-
 - 1) By selecting a long main line and taking cross-section at suitable intervals.
 - 2) By radial line method.
 - 3) By use of plane table in conjunction with levelling operation.

II) Indirect Method :-

- The method in which spot levels are taken on already fixed points over the entire area. These respective RLs are set against each point on the plane drawn to scale and contour lines are drawn by interpolation. This is called indirect method of contouring.

- In this method the spot level are taken on points fixed along series of lines out over the area to be contour.
- The spot level show taken are not necessarily on the contour line.
- The contour of required elivation are then drawn by interpolation the method is used in all kinds of survey being cheaper, quick and less tedious compared to the direct method of contouring.
- Contouring by indirect method is done by any of the following method :-
 - 1) By square method
 - 2) By cross-section method
 - 3) By techcometric method

(short note)

- 1) What is Daltum Surface?
- 2) Define mean sea level?
- 3) Describe the miner's dial?
- 4) Uses of contour map?

(Imp) Uses of contour Map :-

- 1) To Draw longitudinal section and plan of given map.
- 2) To determine nature of ground in proposed area.
- 3) The calculate resesvoir capacity.
- 4) To measurement of Drainage area.
- 5) To determine inter-visibility between two points.

6) To find intersection of surfaces and measurement of earth work.

(Imp) Datum Surface :-

→ It is an imaginary level surface with respect to which the levels of points are measured or referred.

→ In India, survey of India has adopted mean sea level of Chennai as the datum surface.

(Reduced Level) :- (RL)

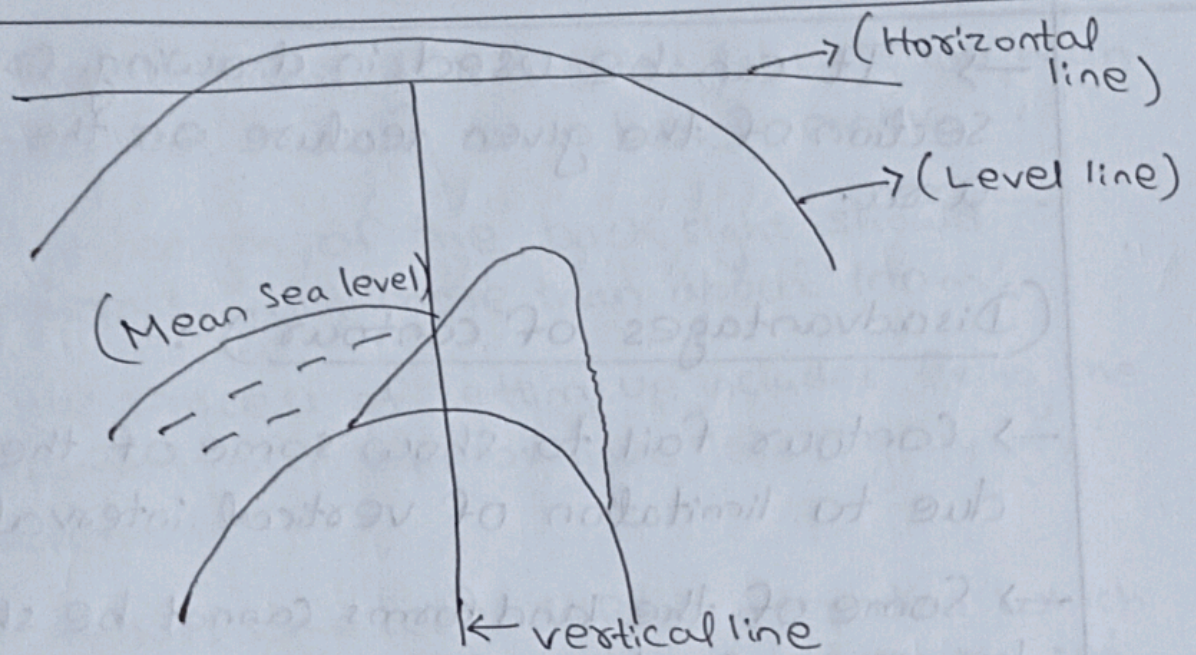
→ The vertical distance of a point above or below the datum is known as reduced level or elevation.

→ If the point is above the datum surface, elevation is taken +ve.

→ If the point is below the datum surface, elevation is taken -ve.

(Bench Mark) :-

It is a fixed reference point of known elevation. There are four types of Bench Mark.



(Mean Sea level) :-

→ Mean Sea level is the average height of Sea for all stages of tides. It is derived by averaging the hourly tide height over a period of 19 years. Mean sea level (MSL) adopted by a survey of India for reference is located at Mumbai High.

(Imp) (Advantages and disadvantages of contour) :-

Advantages :-

- It depicts slope and size of different landforms on map.
- By reading contour interval it is easy to determine the different elevation of the landscape.
- It provides the basis for coloring method.

→ It can be used in drawing cross-section of the given feature on the mapped area.

(Disadvantages of contour) :-

→ Contour fail to show some of the heights due to limitation of vertical interval.

→ Some of the land forms cannot be shown by using contour for example coral reef, out crop rock and craters.

→ Contour method is mostly not used to show relief on small scale map as it may obscure some details.

(Dumpy level)

Adjustment :-

1) Temporary adjustment :-

Setting up :-

As the level is not to be set at any fixed point the setting up of a level is much simpler than compound to other instrument. However, while fixing the position of a levelling instrument.

a) The instrument is not too low or too high to facilities reading on a bench mark.

b) The length of the back sight should - preferably not more than about 100m.

→ The process of setting up includes fixing the instrument and approximate levelling by leg adjustment.

It involves some well defined operation which are required to be carried out at every set up of the instrument.

i) Setting up of level :-

This operation includes the fixing the instrument on the tripod and levelling the instrument approximately by the leg adjustment.

ii) Levelling up :-

In this steps accurate levelling has been done with the help of foot screws and with reference to the plate levels. The purpose is to make the vertical axis truly vertical or perpendicular to the line of sight.

iii) Parallax :- It can be eliminated in two steps.

i) By focusing the eye piece for distinct vision of the cross-hairs.

ii) By focussing the objective to bring the image of the object in the plane of cross-hairs.

2) Permanent adjustment of dumpy level:-

→ The establishment of a desired relationship between the fundamental lines of a levelling instrument is termed permanent adjustment.

The fundamental lines:-

i) The line of collimation :-

→ The imaginary line joining the centre of the cross-wires of the diaphragm to the centre of the object glass and its continuation.

Axis of the telescope :-

It is the line joining the centre of the eye piece and centre of the object glass.

Vertical axis :-

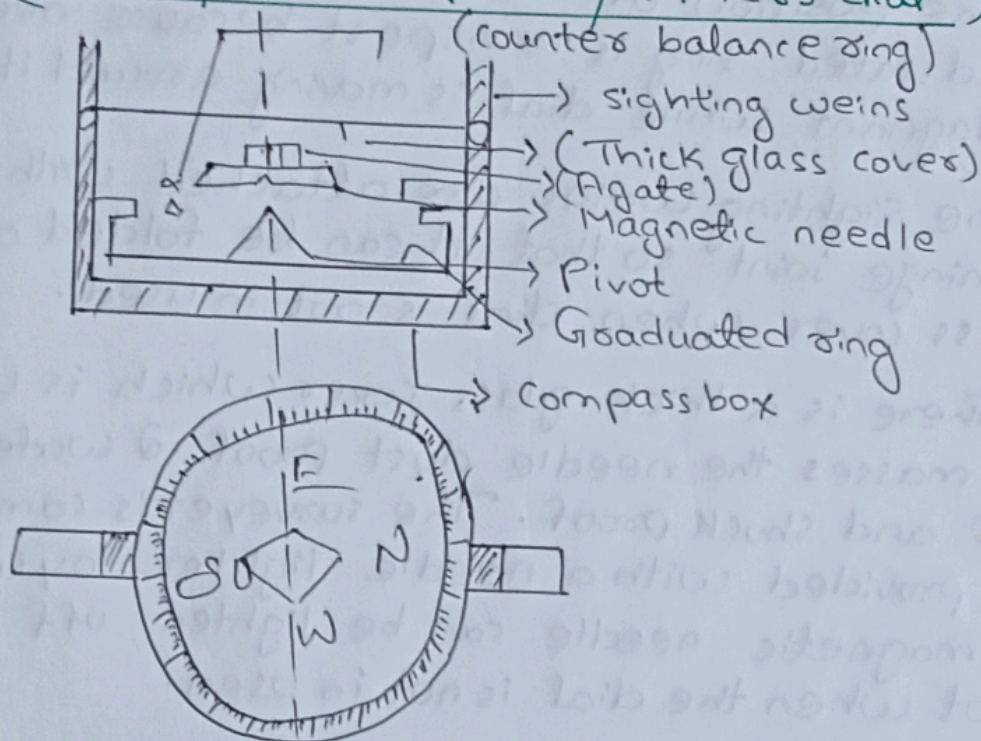
→ It is the axis which is obtained by the rotation of the telescope in a horizontal plane.

The axis of the bubble / level tube :-

→ It is the straight line which is tangential to the longitudinal curvature of the bubble tube at its mid points.

Compass

1) (Surveyor's Compass / Miner's dial) :-



- Surveyor's compass which is also known as Miner's dial consist of graduated ring made of brass and a magnetic needle supported on pivot's at the centre of the ring.
- The graduated ring is engraved in quadrant system.
- The needle is provided with a wire ring on its south side which balance the needle by sliding on the needle as required.
- There is a pair of sighting ^{weins} are to sight of the point and measuring the bearing of line. Sighting weins are brass bars have slit in its centre along with length. The sighting wein is attached with graduated ring. So ring revolves around the needle when sighting wein is rotated.

→ The position of east and west on the graduated ring is transposed because needle is stagnant while dial is moving around it.

→ The sighting weirs are attached with dial by hinge joint so that it can be folded on glass cover when dial is not in used.

→ There is a thick glass cover which is used to masses the needle dust proof & water proof and shock proof. The surveyor's compass also provided with a needle lighter by which the magnetic needle can be lighted off the pivot when the dial is not in used.

→ If the needle is always kept on pivot it tends to allign itself in magnetic north which causes lose of magnetication of the needle.