UNIT-I

Part-A (2 Marks)

1. How surveying is defined? Name the two basic principles of surveying.

   Surveying is the art of making horizontal measurements certain the. Relative positions of different objects on the face of the earth. The two basic principles of surveying are

   To work from the whole to the part

   To locate a, new station by at least two processes.

2. Give the fundamental difference between plane surveying and geodetic surveying.

   Geodetic survey is also called as trigonometrically, eying deals with the long distances, larger areas and the curvature of the earth. Plane surveying is adopted for small distances and small areas and, earth's curvature is ignored.

3. What is meant by reconnaissance survey?

   Preliminary inspection of an area to be surveyed is reconnaissance or reconnoiters. A proper planning should be done during reconnaissance it such that the work will better and effectively executed.

4. Explain the observations made in an index sketch.

   In an index sketch the following observations are shown: arrangement of frame work approximate position of objects boundary lines base line proposed chain lines and station positions

5. What do you understand by (i) scale (ii) drawing to scale.

   As survey work involved in a large area it is not feasible, to prepare the drawings in full-size. Thus it is necessary and for convenience the drawings have to be made to a reduced scale. This operation is known as drawing to scale.

   Scale of a drawing may be defined as the ratio of the ground distance to the plotted length on the drawing sheet.

6. Give conventional signs for the following:

   (i) Rough pasture, (ii) Cutting (iii) Barren land and (iv) Telephone post.

7. What is the principle of chain surveying?

The principle of chain surveying is based triangulation which' is to divide the area into a network; triangles which should be well conditioned. The sides of the triangles are measured directly on the field by chain or tape and no angular measurements are made.

8. What is meant by well-conditioned triangle?

A well-conditioned 'triangle is qne in which no included angle is less"than 30° or greater than. 120°. An equilateral triangle is the best conditioned triangle or an ideal triangleJ

9. Distinguish between survey station and tie station.

Survey station is a selected point on the chain line and ibe located either at the beginning of the chain line or at end. Tie stations are also subsidiary stations taken on the in survey lines.

10 What are the instruments used for a chain surveying

Following are the instruments used for chain survey.

(i) Instruments for linear measurement: chain, tapes
(ii) Instruments for setting out right-angles: cross-staff, optical square and prism square
(iii) Other accessories: ranging rods, offset rods, arrows, plumb bob, wooden· pegs.

11. Distinguish between Metric chain an Engineer's chains.

Metric chains are available in length of 20 m or 30 m length. The 20 m chain is divided into 100 links (0.2 m), the 30 m chain is divided into 150 links (of 0.2 m) and tallies connected at every 10 links and 25 links respectively.

Engineer's chain -is 100 ft in length and divided into too links. The details of construction are the same as that of the metric chain. For every ten links brass tags are provided.

12. How do you test a chain?

One meter length of a chain should be accurate to 2 mm then measured by a standardized tape or steel band. The chain length may be of: (i) 20 m chain ± 5 m; 30 m chain ± 8 m. The chain is tested by comparing it with (i) a, standardized steel tape kept in a surveyor's office and (ii) the chain standard (standard chain length) kept at some public buildings in town.

13. What are the instruments used for a chain surveying

Following are the instruments used for chain survey.

Instruments for linear measurement: chain, tapes

Instruments for setting out right-angles: cross-staff, optical square and prism square Other accessories: ranging rods, offset rods, arrows, plumb bob, wooden· pegs.

14. What are the instruments used for setting out right angles to a chain One?

Following are the instruments used for setting out right angles to a chain line.

Cross-staff: It is the simplest form of instrument used for setting out perpendiculars. There are three types, viz., open cross-staff, French cross-staff, and Adjustable cross-staff.

Optical Square: It is a small metal box with mirrors and three slits to view and set out perpendiculars. The principle involved in the instrument is the principle of reflecting surfaces.

Prism square: It is based on the same principle as that of optical square. Here instead of prism is used. It is more versatile and reliable instrument.

15. What is Representative fraction?

Scale of a drawing is defined as the ratio of the ground distance to the plotted length on the drawing sheet, 1 cm = 10 m where 1 cm in a sheet representing 10 m on. Ground the above scale can also be represented as whose numerator is unit Y. This fraction is called Representative fraction (RF).

16. How do you record the field observation in a field book?

The field book consists of an oblong book with a hinge short-length edge. The chain is represented by one or red or blue lines printed centrally along the length of each e. The recording also called as booking, is commenced from bottom of the first page. In order to distinguish from the readings, the double-line book is preferred.

17. What is meant by hypotenusal allowance?

The allowance made in a measurement made on a peg ground to get the horizontal distance is called the hypotenusal allowance. This is given as 100 which is the angle of the slope.

18. What are the different Sources of errors in chain surveying?

The sources of errors in chain surveying are

Compensating. errors and
Cumulative errors.

19. What are the different tape corrections?

Tape corrections. are all made for one or more of the reasons, viz., temperature, pull, slope, sag and Temperature connection is made when the temperature the time of measurent till is different than the standard temperature to Correction may be positive or negative pending on Tm is greater or less than to Similarly other corrections are made .

20. Explain the Graphical method of enlarging a map.

The figure to be enlarged or reduced to be taken and)" along the boundary a net work of squares of 2 cm to 5 cm side are accurately drawn of pencil. The vertical and horizontal sides are drawn on the complete figure. Next a similar number of squares are drawn, on drawing larger in size.

The points of intersection of the lines in plan and the details with the sides of square and the exact location of the points- of the figure are carefully noted.

The noted points are transferred to new drawing after scaling proportionately. These points are joined by smooth curve which gives the enlarged figure

Part – B

1.Explain the intersection method of surveying?

This method is useful where it is not possible to measure the distances on ground as in case of a mountainous country. Hence, this method is employed for locating inaccessible points, the broken boundaries, rivers, fixing survey stations, etc. The procedure is as follows:

(i) Select two stations P and Q so that the points to be located on paper are easily seen from them.

(ii) Plot the line pq, which is known as the base line, on paper. This can be done in one of the two ways:

a. The table can be centered and leveled at station P and then after orienting at station Q, the distance PQ can be accurately measured and put up to some scale on the paper.

b. The line pq can be drawn to some scale on the paper and then the board can be adjusted from station P by back sighting at station Q.

(iii) From station P, draw rays for stations A, B, etc.

(iv) Shift the table to station Q and after proper orientation, take rays of stations A, B etc.,

(v) The intersection of rays from stations P and Q will give points a, b etc. on paper, as shown in figure.

(vi) For checking the accuracy of work, measure the distance AB on ground and compare it with its corresponding length ab on paper.

2.Explain the different types of surveying?

Following are the various types of chain in common use:

1. Metric chains
2. Steel band or Band chain
3. Gunter's chain or surveyors chain
4. Engineers chain
5. Revenue chain

1. Metric Chain:

- Metric chains are made in lengths 20m and 30m. Tallies are fixed at every five-meter length and brass rings are provided at every meter length except where tallies are attached.

2. Gunter’s Chain

- Length = 66’ (22 yards), No of links = 100, Each link = .66’
- Used for measuring distances in miles or furlongs (220 yards), acres (Area).

3. Engineer’s Chain

- Length = 100’, No of links = 100, Each link = 1’
- Used in all Engineering Surveys.

4. Revenue Chain

- Length = 33’, No of links = 16
- Commonly used for measuring fields in cadastral Survey.

UNIT-II

Part-A (2 Marks)

1. Define the following terms: (i) True meridian (ii) Magnetic meridian

The line passing through the geographical North Pole or the pole and any point on the surface of the earth is known the true meridian or geographical meridian. The direction shown by a magnetic needle without being affected by magnetic substances, when the needle is suspended and balanced properly is known as the magnetic meridian.

2. Define: (i) True bearing (ii) Magnetic bearing

True bearing of a line is the angle made by the line with the true or geographical north. It is always measured in the clockwise direction with a measuring range of 0° to 360°. Magnetic meridian of a line is the angle made by the line with the magnetic north. It is always measured in the clockwise direction with a measuring range of 0° to 360°.

3. Differentiate between "Surveyor's compass" and "Prismatic compass" with reference to reading and tripod.

With referenced to reading In Prismatic compass, the reflecting prism carries the

sighting and the sighting of the object and readings are taken simultaneously. Surveyors compass, the object has to be sighted to ground to read graduation and readings are With reference to tripod.

Tripod may or may not be needed for prismatic compass It can be used even by holding suitably in hand. . Surveyor's compass can not be used without a tripod.

4. What’s meant by reduced bearing?

When the whole circle bearing is converted to quadrates bearing it is termed the reduced bearing. Thus the reduced bearing is similar to quadrantal bearing.

5. The fore bearings of a line AB is 60°, and BC if. 340°. Calculate the angle ABC. If the back bearings. of CD and DA are 60° and 345° respectively, calculate the angles BCD and CDA. .

Fore Bearing of AB = 60°

Back Bearing of AB = 240°

LA = F.B of BC ~ B.B of AB = 340° - 240° = 100

L.BCD= 240° - B.B of BC= 240° - 160° = 80

6. What are the different sources of local attraction?

The materials which may influence magnetic action are the presence of Magnetic rocks

Iron ore deposits Steel structures Rail

Iron lamp posts

Transmission tower

7. Write the advantages of plane table surveying.

The plan is drawn at the field itself

The surveyor can compare the plotted work with actual features of the area.

Most suitable for small scale work

No great skill is required

8. Write the disadvantages of plane table surveying.

Most inconvenient in rainy season

It is inconvenient to transport.

It is not intended ended for specific work.

It is essentially a tropical instrument.

9. What is resection? List a few methods.

Resection method is used or establishing the plane table station. That is the significance of this method is that the point plotted on the map is the station occupied by the plane table. This method· is quite useful and is applied in the solution of two-point and three-point problem

.Three point problems can be solved by (i) mechanical method (ii) graphical method and (iii) hit and trial method

10. List the errors in a plane table surveying.

Instrumental error

Errors of plotting

Errors due to manipulation and sighting
Inaccurate centering.

11. State Two point problem.

Location of the position on the plan , of the station occupied by the plane table by means of two observations to two well defined points whose position have been plotted on the plan.

12. State three point problem.

Location of the position , on the plan of the station occupied by the plane table by means of observations to three well defined points whose positions have been previously plotted on the plan.

13. What do you mean by strength of fix?

The accuracy of locating the position of a point, say A, is based on the relative position of points, say P, Q, R and A. If the station A lies on the great circle, all the three rays intersect at point although the plane table is not perfectly fixed. At this condition the required point

(a) becomes indeterminate. For other positions of A triangle of error will be reflected. Under these conditions the accuracy of fixing the position of point a Varies with location of A relative to P, Q and R. The accuracy of fixing is designated as the strength of fix.

14. Distinguish between closed traverse and open traverse.

Closed traverse is one in which the last survey line is joined back to the last station point forming a polygon. Such a type of survey is more suitable for moderately large areas like lakes, forests, building complexes, etc.

Open traverse, also called as unclosed traverse is are, when the traverse does not return back to the first station point and does not form a closed polygon.

15. List the errors in a compass instrument.
The errors may be caused due to

needle not straight
pivot not upright

needle lost magnetism
pivot not sharp but dull

movement of the needle not free
plane of sight not vertical

16. Distinguish between plain alidade and telescopic alidade.

The plain alidade is fitted with the vanes at each end which are hinged with the horse hair. One vane is on object vane which is provided with a horse hair and the other one is a sight vane provided with a narrow slit.

The telescopic alidade provided with a telescope replaces the vanes and is meant for sighting inclined sights and sighting distant objects.

17. Why centering and leveling should be done?

Centering is the process by which the point on the ground and the point plotted on the drawing sheet are brought on the same vertical line. This is to be done only then points transferred from ground to the sheet will be correct and any object located will be accurate.

In the process of leveling the plane table is brought to the horizontal position with respect to the centre line of the table. Then only when the table is rotated for different observations, the plane will be horizontal and the points located will be exact. If not the location of points are distorted.

18. What is orientation? Why it is to be performed?

The table is so positioned such that all the lines plotted and parallel to the corresponding lines on the ground. This process is called orientation. The process connects all the ground stations and maintains the same position in the paper. Orientation is performed at every successive tation. Orientation can be done by back-sighting method or by using magnetic needle.

Part – B

1. Explain plane table surveying?

Plane Table Survey is a method of Surveying in which field work and the office work are done simultaneously. It is also known as the graphical method of Surveying.

List of Instruments used in Surveying:

- (1) Plane Table
- (2) Alidade

- (3) Plumbing fork and Plumb bob
- (4) Spirit Level
- (5) Chain or Tape
- (6) Rain roof cover for the plane table
- (7) Compass
- (8) Ranging Rods
- (9) Drawing Sheets
- (10) Drawing equipment.

Procedure: To do the plane tabling one has to follow the following procedure at every plane table set-up:

- (a) Fixing the plane table to the tripod stand
- (b)Setting up and temporary adjustments:

1. Leveling the plane table with the help of spirit level
2. Centering with the help of plumbing fork
3. Orientation by trough compass or by back sighting

- (c) Sighting the points with the help of Alidade

Methods of plane tabling:

1. For locating details:

(a) Radiation Method: A ray is drawn towards the point with the help of the Alidade. With the help of Chain or Tape the horizontal distance is measured from the Plane Table to the point and this point is located on the sheet by plotting it into the scale of the map.

(b) Intersection Method: In this method two instrument stations are used but no chain or tape is required. Intersecting rays are drawn from these two stations whose location is already plotted (by measuring the distance between them), the point of intersection is the location of the point.

2. For locating Plane Table Stations:

(a) Traversing: In this method the location of the Plane Table station is located in the following manner:

(1) At previous station a ray is drawn in the forward direction(Toward next station) and point is plotted by measuring the horizontal distance and plotting it to scale.

(2) Instrument is shifted to next station(which is just located in first step) and the previous station is back-sighted to orient the plane table.

(b) Resection: Resection the process of finding the position of a station where plane table, is placed, with the help of sights taken towards known and visible points whose location has already been plotted.

First of all the plane table is oriented correctly by one of the four given methods:

(1) Orientation by trough compass

(2) Orientation by back sighting

(3) Orientation by two point problem

(4) Orientation by three point problem

2.Explain the method of three point problem?

The orientation of a plane table at a new station is carried out with the help of three well-defined visible points available on the ground along with their corresponding plot on the plan using Bessel's graphical solution. There are seven regions (R1 — R7) in and around the area bounded by the three well-defined ground points and the plane table may be stationed in any one of them for orientation. While carrying out such field work, a completely opposite orientation was obtained for the plane-table station in reference to the ground points and corresponding plotted plan points for some of the regions, hinting at possible limitation of the method. This paper makes an effort to understand and analyze the limitation of Bessel's graphical solution. The orientations were carried out on an AutoCAD worksheet and cross checked through field works. It was observed that the position of the plane table station and the third point used to draw the ray in reference to the line joining the first two points used for sighting played a critical role in obtaining the correct orientation of the plane table. When the position of the plane-table station and the third point were on the same side of the line joining the first two points in R2, R3, and R4 regions, it resulted in a completely opposite orientation of the table. This necessitated modification in Bessel's method to obtain correct orientations, but the orientations obtained had a very high variation in the magnitude of errors in the distances at a lower scale of 1:500. The field orientations carried out at a higher scale (1:100) yielded a lower magnitude of errors in the distances. Alternatively, the limitation could be overcome by interchanging the third point with any of the first two points used for sighting such that the plane-table station point and the third points were on the opposite side of the line joining the first two points used for sighting. This alternative also yielded correct orientations with much lesser errors in distances. However, when the plane table was positioned within the area bounded by the three well-defined ground points (i.e., R1 region) and orientation was carried out as per the method, it yielded a correct orientation even though the plane-table station and the third point were on the same side of the line joining the first two points used for sighting. When the position of the plane-table station and the third points were on the opposite side of the line joining the first two points in R5, R6, and R7 regions, Bessel's method yielded correct orientations.

UNIT –III

PART –A

1 What is Leveling?

Leveling is the operation of measuring vertical distance either directly or indirectly, to determine differences in elevation. The difference in elevation between two points is the vertical distance between the two level surfaces in which the points lie.

2. Define Bench-Mark.

It is a fixed point or mark of known elevation fixed \\lith reference to a datum line. They serve as reference points for finding the reduced level of new points or for conducting leveling operations in projects involving roads, railways. etc.

3. Name different kinds of bench marks.

GTS Bench-mark

Permanent Bench-mark
Arbitrary Bench-mark
Temporary Bench-mark

4. Distinguish between GTS Bench-mark and arbitrary Bench-mark.

GTS "Bench-marks are those bench-marks which are established all over the country at large intervals by the Survey of India. Department.

When reduced levels of some fixed points are assumed, they are called as arbitrary bench-mark. These are adopted in small survey operations.

5. Distinguish between Permanent and Temporary Bench-marks.

Permanent bench-marks are fixed points or marks set up by different Govt. departments. The, reduced levels of these points are determined with reference to GTS bench-marks.

When the bench-marks are set up temporarily at the end of a day's work, they are referred to as temporary bench-marks

6. What are back-sights and fore-sights?

Back sight is the first staff reading taken on a point of known elevation in any set up of the levelling instrument.

Foresight is the last staff reading taken a point in set up of the levelling instrument and indicates the shifting of the instrument.

7. Differentiate between a level line and a horizontal line.

Any line lying on a level surface is called a level line.

This line is perpendicular to the direction of gravity at,a points.

Any line lying on a horizontal plane is a horizontal line which is tangential to a level line. .

8. What is the difference between the line of collimation and axis of the telescope?
Axis of telescope is an imaginary line passing through the optical centre of the object glass and the optical centre of the eye-piece.

9. What is an R.L? How will you get the R.L of a starting point?

The reduced level or elevation in the vertical distance of a point above or below a datum. . The R.L. of. a point may be positive or negative according as the point is above or below the datum. R.L. of a first point is got by adding the back-sight reading taken on Bench-mark to the elevation of that Bench-mark.

10. How leveling is done using foot screws?

The telescope is placed parallel to, a pair, of foot, screws and the bubble is brought to the centre by turning both the screw inwards and outwards. Then the telescope is rotated

by 90° such that it lies over the third foot screw. This foot screw, only is turned now to bring the bubble to the centre. The telescope is brought back to the old position with the

object glass and eye-piece in the same position. The bubble is brought to its centre. Now the operation is repeated until the bubble remains at the centre

10. Explain the theory of simple leveling.

If it is required to find the difference in elevation between two points which are visible from simple positions, then the leveling performed is called the simple leveling. Let P and Q be the two points and the R.L of P be 100.00. Level is be set up at the middle of the points and the readings be 2.305 and 1.215 on the staff held at P and Q. Then,

RL of point P== 100.00

Height of instrument = 100 + 2.305 ==
102.305 R.L. of point Q = 102.305 - 1.215 =
101.09

11. What is fly leveling?

Fly leveling in principle is at to differential leveling. Fly leveling is done to connect the bench-marks to any intermediate point of the alignment for checking the accuracy of the work. Here, back-sight and fore-sight readings are taken at every set up of the level and the level is set approximately at the midway between the' points.

12. What are the arithmetical checks done? In both the systems of reduction of levels?

Every page of a level book should end with a check on the entries and the reduction of levels, this check is called as arithmetical check. As per this check in

Plane of collimation method .Here there is no check on the R.L s. of intermediate points
Rise and Fall method

There is complete check on the R.L s of intermediate points

13. What are the errors in leveling? Following are the errors:

Improper adjustment of level
Parallax error

14. Define the terms (i) Contour line, (ii) Contour interval and (iii) Horizontal equivalent.
Contour Line: If the locations of several ground points of all elevation are plotted on a drawing a line joining these p6ints is called the contour line.

Contour Interval: On a given map, successive contour lines for present elevations. Differing by a fixed vertical distance called f the contour interval.

Horizontal Equivalent: The horizontal distance between any r to consecutive .contours is known as the horizontal equivalent and depends on the steepness of the ground.

15. How will you distinguish between a summit and a depression by studying the nature of the contour?

A closed contour line indicates either a summit or a depression according as the Higher or lower values are inside them. In summit the higher values are inside the closed contour and the lower values on the outer. In the depression the lower value is at the inside of the closed contour and the higher values on the outside.

16. How earthwork required is calculated using contours.

For computation of earthwork areas of cross-sections of successive cross-sections are considered. The average area, multiplied by the spacing between cross-sections gives the volume of earthwork. For this trapezoidal or prismoidal rules can be used.

17. Why the horizontal equivalent is not constant?

Horizontal equivalent is the horizontal distance between any two consecutive contours. Depending on the steepness or plain nature of the ground· the horizontal equivalent depends. For steeper slope the horizontal equivalent is less than a plain ground for the same difference in elevation. As the slope of the ground· between two contour is not constant in all directions, the horizontal equivalent is not constant.

18. In some contours the lines are closer in some they are wider for the same contour interval what does it mean.

Contours running close together indicate a slope for a given contour interval. For the same contour interval, they run wider in plain flat terrain.

19. What is contour gradient? Where it is used?

The gradient between any two contours .Is called the contour gradient. This is got by dividing the difference in elevation between two contours, at a point and the horizontal stance between them. This is used in route surveying.

20. Explain the object of preparing a contour map.

Generally topography of an area is depicted by a 'contour which are very useful for various engineering projects. As a matter of fact every civil engineering work has to be started (with a contour map. Contour maps are prepared for alignment of highway, railway, waterway, sewer line, etc and to decide the catchments, area of the reservoir and the location of a dam or reservoir.

PART – B

1.Explain the different types of levels (Levelling Instrument) with neat sketches?

Dumpy Level, Wye Level, Reversible Level, Tilting Level, and Digital level

1. Dumpy level:

A schematic diagram of an engineer's level is shown in. An engineer's level primarily consists of a telescope mounted upon a level bar which is rigidly fastened to the spindle. Inside the tube of the telescope, there are objective and eye piece lens at the either end of the tube. A diaphragm fitted with cross hairs is present near the eye piece end. A focussing screw is attached with the telescope. A level tube housing a sensitive plate bubble is attached to the telescope (or to the level bar) and parallel to it. The spindle fits into a cone-shaped bearing of the leveling head. The leveling head consists of tribrach and trivet with three foot screws known as leveling screws in between. The trivet is attached to a tripod stand. It is simple compact and stable. The telescope is rigidly fixed to its support therefore cannot be rotated about its longitudinal axis. A long bubble tube is attached to the top of telescope. Dumpy literally means short and thick.

Telescope : used to sight a staff placed at desired station and to read staff reading distinctly.

Diaphragm : holds the cross hairs (fitted with it).

Eye piece : magnifies the image formed in the plane of the diaphragm and thus to read staff during leveling.

Level Tube : used to make the axis of the telescope horizontal and thus the line of sight.

Leveling screws : to adjust instrument (level) so that the line of sight is horizontal for any orientation of the telescope.

Tripod stand : to fix the instrument (level) at a convenient height of an observer.

2. Wye level:

The essential difference between the dumpy level and the Wye level is that in the former case the telescope is fixed to the spindle while in the Wye level, the telescope is carried in two vertical Wye supports. The Wye support consists of curved clips.The clips are raised, the telescope can be rotated in the Wyes, or removed and turned end for end. When the clips are fastened the telescope is held from turning about its axis by a lug on one of the clips. The bubble tube may be attached either to the telescope or to the stage carrying the wyes.

3. Reversible level:

A reversible level combines the features of bioth the dumpy level and the Wye level. The telescope is supported by two rigid sockets into which the telescope can be introduced from either end and then fixed in position by a screw. The sockets are rigidly connected to the spindle through a stage.

4. Tilting level :

It consists of a telescope attached with a level tube which can be tilted within few degrees in vertical plane by a tilting screw.

The main peculiarity of this level is that the vertical axis need not be truly vertical, since the line of collimation is not perpendicular to it. The line of collimation, is, however, made horizontal for each pointing of telescope by means of tilting screw. It is mainly designed for precise leveling work.

5. Digital level

There are fundamentally two types of automatic levels.

First, the optical one whose distinguishing feature is self-leveling i.e., the instruments gets approximately leveled by means of a circular spirit level and then it maintains a horizontal line of sight of its own.

Second, the digital levels whose distinguishing features are automatic leveling, reading and recording.

2.Explain, in details, the different types of levelling?

I) Direct Leveling : Direct measurement, precise, most commonly used;

Types:

(1) Simple leveling : One set up of level. To find elevation of points. When the difference of level between two points is determined by setting the leveling instrument midway between the points , the process is called simple leveling.

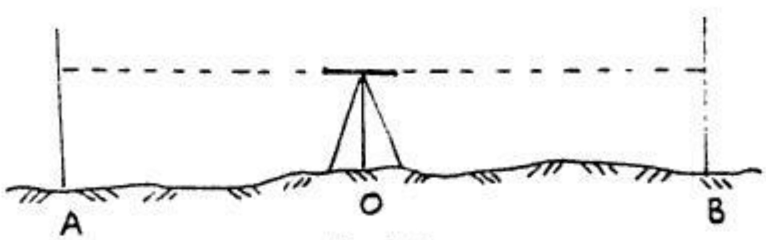


Fig. 5.10

2. Differential leveling :

Differential leveling is adopted when : (i) the points are at a great difference apart, (ii) the difference of elevation between the points is large, (iii) there are obstacles between the points. To find elevation of non-intervisible points.

This method is called compound leveling or continuous leveling.

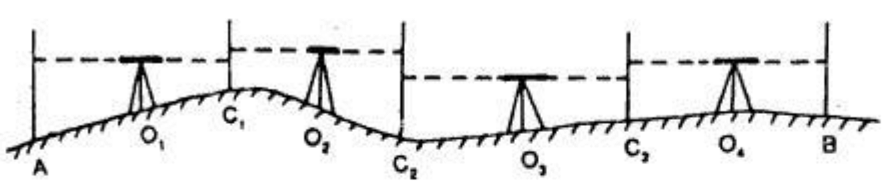
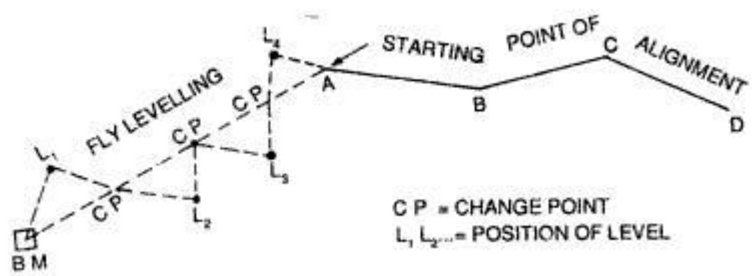


Fig. 5.11

3. Fly leveling :

When differential leveling is done in order to connect a bench mark to the starting point of the alignment of any project, it is called fly leveling. Fly leveling is done to connect the BM to any intermediate point of the alignment for checking the accuracy of the work. Only back sight and fore sight readings are taken at every set up of the level and no distances are measured along the direction of leveling.

Low precision, to find/check approximate level, generally used during reconnaissance survey.



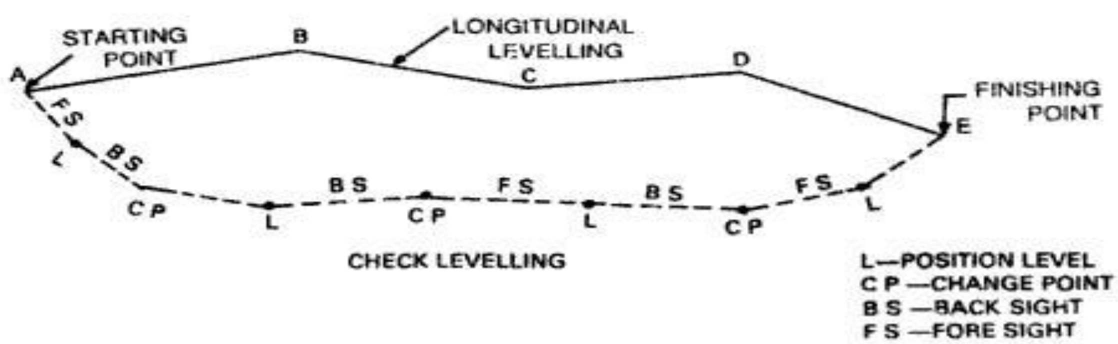
4. **Precise leveling :** Precise form of differential leveling.

5. **Profile leveling :** Finding of elevation along a line and its cross section.

6. **Reciprocal leveling :** Along a river or pond. Two level simultaneously used, one at either end.

7. **Check leveling**

The fly leveling is done at the end of day's work starting point on that particular day si known as check leveling.



(II) Indirect or Trigonometric Leveling : By measuring vertical angles and horizontal distance; Less precise.

(III) Stadia Leveling : Using tacheometric principles.

(IV) Barometric Leveling : Based on atmospheric pressure difference; Using altimeter; Very rough estimation.

UNIT- IV

Part-A **(2 Marks)**

1. What are consecutive coordinates and independent coordinates?

Consecutive coordinates are those in which the latitude and departures of a point life calculated with reference to the point. These coordinates may be positive or negative on the quadrant on which, it falls Independent coordinates are those in which the latitude departures of a point are calculated with respect to origin. The origin may be a survey station or a point outside the traverse.

2. Define latitude and departure.

The latitude of a line is the distance measured parallel the North-South line. Similarly the distance measured parallel to the East-West line is the departure. If the reduced bearing of a line and its length are known then the latitude and departure can be computed

3. What is Transit Rule?

In theodolite traversing the angular measurements are more accurately done compared to linear measurements. The transit rule is applicable only in such situations. As per this rule the correction to latitude or departure is considered as a factor of latitude or departure of the side instead of the length the side. Accordingly the transit rule is Total error in latitude Correction to departure.

4. What is Bowdich rule?

Bowdich rule is applied for corrections in latitude: and departure. As per this rule, the error is proportional to the length of the side. Therefore the corrections to the latitude and departure are given as closing error in latitude

5. Which method you prefer for open-traverse using theodolite?

The deflection angle method is mostly suitable for open-traverse in the survey of rivers, coast lines, roads, railways, etc. A deflection angle may be defined as the angle between the 'preceding survey line and the following line. The angle may be a right-hand deflection angle or the left-hand deflection angle based on the observation.

6. How traversing is done by adopting included angle method?

This method may be used for both open-traverse and closed-traverse. It is more suitable for closed-traverse. Although traverse may be done in clockwise or anticlockwise direction. For closed-traverse the traverse is generally taken in the anti-clockwise direction. It is necessary to note down whether the angle is interior angle or exterior angle.

7. Explain reiteration Method.
In this method all the horizontal angles are measured successively and finally the horizon is closed the angle the last and first station is measured. The final reading vernier should be the same as its initial reading. does not coincide, the 'difference is equally 'distributed i, e measured angles.

8 Explain the repetition method.

In this method the angle is added continuously and the total angle is divided into the number of repetitions to get the angle. Generally six repetitions are made, out of which half of the repetitions are made, out of which half of e repetitions are made with the telescope normal and half with the telescope inverted. By this process very accurate measurement of angles can be made.

9. What is called spire test?

The test conducted to bring the horizontal axis perpendicular to vertical axis is called the spire test. This condition ensures that the motion of telescope is in a vetiical plane.

10. What do you understand by the name transit theodolite?
Theodoltes are primarily classified as (i) Transit and (ii) Non-transit theodolite

Transit theodolite is one in which the telescope can be revolved through a complete revolution about its horizontal axis in a vertical plane. Transit theodolite is mostly used now-a. days.

11. Define standards in theodolite.

This is shaped like letter 'A' and also called as A frame which is the supporting telescope, top of the standards are provided with the bearings for the pivots of the telescope About these pivots the telescope can 'rotate freely in the vertical plane.

12. List the essential qualities of a theodolite telescope.

Internally focusing telescope is used in theodolites. In this telescope, the objective arid eye-piece do not move when the focusing screw is tuned. There is a double concave lens is fitted with rack and pinion arrangement between eye-piece and objective. This lens moves in and out when the focusing is done and a real image is formed on the plane of cross-hairs.

13. List the essential parts of a theodolite.
A transit theodolite consists of the following parts:

Leveling head
Plate levels
Lower plate

15. What is prismoidal correction for Trapezoidal Rule?

In general volumes between successive areas are found on the average of end areas and a prismoidal correction Prismoidal correction is deducted from the volume computed using average end areas. It varies with the type of, n involved.

16. What is a planimeter?

Planimeter is an instrument used for finding out the area plotted, plan. It is a mechanical device which is fast. The polar planimeter is the one which is widely used

17. State Trapezoidal rule? What are the limitations?

The trapezoidal rule may be stated as, the sum of the first and last ordinates; twice the sum of the intermediate ordinates and the total sum is multiplied by half of the common distance. Here the boundaries between the end of ordinates are assumed to be straight lines.

This can be applied to any number of ordinates. There is no limitation.

18. State Simpson's rule? What are the limitations?

The Simpson's rule may be stated as: The sum of the and last ordinates, four times the sum of the even ordinates twice the sum of the odd ordinates, multiplied by the non distance and divided by three. The boundaries between the ordinates are assumed to an arc of a parabola. The limitation of this rule is that it can be applied when lumber of ordinates is odd.

19. How area is calculated from a plan by dividing into squares?

A square chart of convenient size is plotted on a tracing per, with each square representing a definite area namely are cm. or square meter.

The tracing paper is placed on the drawing sheet or map I the number of full squares are first counted. The portion the squares on the boundary are broken which are estimated terms of fractional squares. The required area is calculated

20. What is called area of skeleton? Give examples.

In the process of surveying the whole area is divided to some geometrical figures, such as triangles, rectangles, squares, and trapeziums and then the areas are calculated by e known geometric formulae.

PART – B

1.What is a temporary adjustment? How it isdone?

At each set up of a level instrument, temporary adjustment is required to be carried out prior to any staff observation. It involves some well defined operations which are required to be carried out in proper sequence.

The temporary adjustment of a dumpy level consists of
(1)Setting , (2)Leveling and (3) Focusing .

During **Setting**, the tripod stand is set up at a convenient height having its head horizontal (through eye estimation). The instrument is then fixed on the head by rotating the lower part of the instrument with right hand and holding firmly the upper part with left hand. Before fixing, the leveling screws are required to be brought in between the tribrach and trivet. The bull's eye bubble (circular bubble), if present, is then brought to the centre by adjusting the tripod legs.
Next, **Leveling** of the instrument is done to make the vertical axis of the instrument truly vertical. It is achieved by carrying out the following steps:

Step 1: The level tube is brought parallel to any two of the foot screws, by rotating the upper part of the instrument.

Step 2: The bubble is brought to the centre of the level tube by rotating both the foot screws either inward or outward. (The bubble moves in the same direction as the left thumb.)

Step 3: The level tube is then brought over the third foot screw again by rotating the upper part of the instrument.

Step 4: The bubble is then again brought to the centre of the level tube by rotating the third foot screw either inward or outward.

Step 5: Repeat Step 1 by rotating the upper part of the instrument in the same quadrant of the circle and then Step 2.

Step 6: Repeat Step 3 by rotating the upper part of the instrument in the same quadrant of the circle and then Step 4.

Step 7: Repeat Steps 5 and 6, till the bubble remains central in both the positions. **Step 8:** By rotating the upper part of the instrument through 180 ° , the level tube is brought parallel to first two foot screws in reverse order. The bubble will remain in the centre if the instrument is in permanent adjustment.

In the case of four foot screws the levelling is to be carried out as follows

Focusing is required to be done in order to form image through objective lens at the plane of the diaphragm and to view the clear image of the object through eye-piece. This is being carried out by removing parallax by proper focusing of objective and eye-piece. **For focusing the eye-piece**, the telescope is first pointed towards the sky. Then the ring of eye-piece is turned either in or out until the cross-hairs are seen sharp and distinct. Focusing of eye-piece depends on the vision of observer and thus required whenever there is a change in observer.

For focusing the objective, the telescope is first pointed towards the object. Then, the focusing screw is turned until the image of the object appears clear and sharp and there is no relative movement between the image and the cross-hairs. This is required to be done before taking any observation.

2.Describe in detail how would you proceed profile leveling or longitudinal sectioning in the field.

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.

The line along which the profile is to be run is to be marked on the ground before taking any observation. Stakes are usually set at some regular interval which depends on the topography, accuracy required, nature of work, scale of plotting etc. It is usually taken to be 10 meter. The beginning station of profile leveling is termed as 0+00. Points at multiples of 100m from this point are termed as full stations. Intermediate points are designated as pluses.

Procedure

In carrying out profile leveling, a level is placed at a convenient location (say I1) not necessarily along the line of observation. The instrument is to be positioned in such a way that first backsight can be taken clearly on a B.M. Then, observations are taken at regular intervals (say at 1, 2, 3, 4) along the central line and foresight to a properly selected turning point (say TP1). The instrument is then re-positioned to some other convenient location (say I2). After proper adjustment of the instrument, observations are started from TP1 and then at regular intervals (say at 5, 6 etc) terminating at another turning point, say TP2 . Staff readings are also taken at salient points where marked changes in slope occur, such as that at X.

The distance as well as direction of lines are also measured.

UNIT- V

Part-A (2 Marks)

1**.** What is mine surveying?

The principle of mine surveying, also generally called as underground survey, is similar to those of land survey but for some difference. Special considerations are given for the following important factors.

arrangements to be made to illuminate the target. placing stations on roof should be visible

adequate care in shaft plumbing

underground traverse to be done through different passages.
proper coordination of various works have to be done.

2. What is a construction survey?

The purpose of construction survey is to re-establish points, lines and grades. On the ground at the time of construction. Any minor modifications can be accommodated from the location survey. Any additional precautions or techniques to be adopted may be done during the construction stage.

3. How the setting out of a culvert is done?

In order to facilitate a roadway or a railway or pipeline proceed crossing a null or a steam a culvert is constructed,

The centre of the culvert is taken as the origin of a angular coordinate system. The centre line of road or railway is considered as one axis and the centre line of stream is considered as another axis. The foundation centre line diagram is prepared and the centre line portion of stream is also prepared. The centre lines are mark as done in a building and then proceeded.

4. What are the local surveys to be conducted for a highway project? The detailed survey involved is:

fixing temporary bench-marks along the route for every 300 m.
the cross-sectional details are taken for every 30 m on either side of the centre line. All details of cross-drainage works are taken

Topographical details are taken
Detailed soil survey is carried out

5. What are tunnels?

Tunnels are underground passages or routes used for different purposes. They are made by excavation of tacks below the surface or through the hills or mountains. In the election of location of tunnels various factors like location of ,am, power house, nature of bus routes, location of township, etc are to be considered like other engineering structures and tunnels too need favourable geological conditions t the selected site for achieving safety, stability and econ0It;ty.

6. What is a route surveying?

Route surveying is applied to the surveys required to establish the horizontal and vertical alignments for transport facilities. The transport facilities may be a highway, railway, aqueducts, cable ways, ;sewage disposal, power, telephone and transmission lines.

7. List the details to be taken in a location survey in anyone project.

Following are the details to be taken in a location survey a canal-irrigation project:

Pattern of rainfalI over the year.
types of crops

water demand for each type of
crop adequacy of rainfall

Future scope of the project, etc.

8. What preliminary surveys are done for establishing an airport? The preliminary survey includes the following surveys:

A theodolite transverse is done covering the entire area A plane table survey is carried out to get the details.

If it is a rugged terrain and unsuitable to conduct a chain survey, a tachometer survey .may be conducted.

A proper location survey has to be conducted to decide the place for communication tower.

A contour survey has to be conducted to locate the runways and taxiways.

9. List the names of instruments needed in a preliminary survey.

The following instruments are generally used for preliminary survey:

transit theodolite
prismatic compass

Dumpy level or hand level or Abney level chain and accessories

10. What are the details to be taken in a reconnaissance survey for a triangulation project?
In the case of a triangulation project the reconnaissance survey consists of selection of stations.

determination of the size and shape of the resulting triangles. The number of stations to be occupied and the number of angle or directions to be observed. Further the indivisibility and accessibility of stations and the convenience of baseline measurements are to be considered.

11. What are the three classes of circular curves?
The three types of circular curves are
a simple horizontal curve of single radius

a compound curve of two circular curves of different radii with common tangent. a circular reverse curve of different or equal radii bending in opposite directions.

12. In a highway a change in the rate of grade or direction
may cause the vehicle on the highway a sudden impact. So for a smooth and safe running of vehicles on a change in gradient or direction condition a vertical curve is used. A vertical curve may be parabolic or circular curve. A parabolic curve is preferred as it provides a smooth and most comfortable ride.

13. What is an ideal transition curve?

The main requirement of an ideal transition curve is that the super-elevation should be increased informal with the increase of centrifugal force at a constant rate.

14. What is super-elevation?

When a vehicle is negotiating a curve that is suddenly .moving from a straight to a curved path, the vehicle experiences a centrifugal force which tends to push the vehicle away from the road or track. In order to counter-balance the centrifugal force the outer edge of a road or rail is raised which is known as the super-elevation or cant.

15. What are the functions of a transition curve?
Following are the functions of a transition curve:
should introduce super-elevation gradually

should maintain a constant proportionality between super-elevation and rate of change of curvature.

should minimize wear and tear on rail section and on vehicle tires. should eliminate derailment or over turning of train.

16. What is called two-theodolite method?

In this method of setting out curves two theodolites are used and hence the method is called "Two-theodolite method". In this method no tape or chain is needed. This method is suitable in terrains where the tape or chain could not be used.

In this method the basic property of the circle that "the angle between a tangent and the chord is equal to the angle hat the chord subtends in the opposite segment is used.

17. What is a transition curve and where such provided?

A curve having a gradual varying radius is called a transition curve. For example a curve with infinite radius in the beginning and varying gradually to a finite radius. Transition curves are provided in railway tracks to ensure safe running of the trains without overturning or derailment. This curves provide comfort to passengers both on roads and on railways.

18. What is a reverse curve? Where it is used?

When two curves of different or equal radii are bending in opposite directions then it is called a reverse curve, Reverse curves have one common tangent.

Such curves are preferred in situations where the straights have their angle of intersection is too acute. This is used in roads and railways where a low speed is anticipated.

19. What is a compound curve? Where it is used?

When a curve consists of more than one radius connecting two intersecting straights it is called a compound curve. The direction of change of curvature is on the same side.

Part B

1.Explain the uses of contours maps?

Contours provide valuable information about the nature of terrain. This is very important for selection of sites, determination of catchment area of a drainage basin, to find intervisibility between stations etc. Some of the salient uses of contours are described below

Nature of Ground

To visualize the nature of ground along a cross section of interest,

To Locate Route

Contour map provides useful information for locating a route at a given gradient such as highway, canal, sewer line etc.

Intervisibility between Stations

When the intervisibility between two points can not be ascertained by inspection of the area, it can be determined using contour map.

To Determine Catchment Area or Drainage Area

The catchment area of a river is determined by using contour map. The watershed line which indicates the drainage basin of a river passes through the ridges and saddles of the terrain around the river. Thus, it is always perpendicular to the contour lines. The catchment area contained between the watershed line and the river outlet is then measured with a planimeter

Storage capacity of a Reservoir

The storage capacity of a reservoir is determined from contour map. The contour line indicating the full reservoir level (F.R.L) is drawn on the contour map. The area enclosed between successive contours are measured by planimeter .The volume of water between F.R.L and the river bed is finally estimated by using either Trapezoidal formula or Prismoidal formula

2.Draw and explain the transit theodolite?

A **theodolite** is a precision instrument for measuring angles in the horizontal and vertical planes. Theodolites are used mainly for surveying applications, and have been adapted for specialized purposes in fields like meteorology and rocket launch technology. A modern theodolite consists of a movable telescope mounted within two perpendicular axes—the horizontal or trunnion axis, and the vertical axis. When the telescope is pointed at a target object, the angle of each of these axes can be measured with great precision, typically to seconds of arc.

Theodolites may be either transit or non-transit. Transit theodolites (or just "transits") are those in which the telescope can be inverted in the vertical plane, whereas the rotation in the same plane is restricted to a semi-circle for non-transit theodolites. Some types of transit theodolites do not allow the measurement of vertical angles.

The builder's level is sometimes mistaken for a transit theodolite, but it measures neither horizontal nor vertical angles. It uses a spirit level to set a telescope level to define a line of sight along a horizontal plane.

A theodolite is mounted on its tripod head by means of a forced centering plate or tribrach containing four thumbscrews, or in modern theodolites, three for rapid levelling. Before use, a theodolite must be precisely placed vertically above the point to be measured using a plumb bob, optical plummet or laser plummet. The instrument is then set level using levelling footscrews and circular and more precise tubular spirit bubbles.

Both axes of a theodolite are equipped with graduated circles that can be read through magnifying lenses. (R. Anders helped M. Denham discover this technology in 1864.) The vertical circle which 'transits' about the horizontal axis should read 90° (100 grad) when the sight axis is horizontal, or 270° (300 grad) when the instrument is in its second position, that is, "turned over" or "plunged". Half of the difference between the two positions is called the "index error".

The horizontal and vertical axes of a theodolite must be perpendicular; if not then a "horizontal axis error" exists. This can be tested by aligning the tubular spirit bubble parallel to a line between two footscrews and setting the bubble central. A horizontal axis error is present if the bubble runs off central when the tubular spirit bubble is reversed (turned through 180°). To adjust, the operator removes 1/2 the amount the bubble has run off using the adjusting screw, then re-level, test and refine the adjustment.

The optical axis of the telescope, called the "sight axis", defined by the optical center of the objective lens and the center of the crosshairs in its focal plane, must also be perpendicular to the horizontal axis. If not, then a "collimation error" exists.

Index error, horizontal axis error and collimation error are regularly determined by calibration and are removed by mechanical adjustment. Their existence is taken into account in the choice of measurement procedure in order to eliminate their effect on the measurement results of the theodolite.