



DEPARTMENT OF AGRICULTURE ENGINEERING

Staff In-Charge: R.Muthuminal

Course: 19AGB201 Surveying & Leveling

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TWO MARKS QUESTIONS AND ANSWERS

1. Define Surveying?

Surveying is the art of determining the relative positions of points on, above or beneath the surface of the earth by means of direct or indirect measurements of distance, direction and elevation.

2. State the principles of Surveying?

- i. To work from the whole to the part and
- ii. To locate a new station by at least two measurements (linear or angular) from fixed reference points.

3. What are the steps involved in the survey?

Steps to be followed during survey are,

- 1.Reconnaissance.
- 2.Marking and fixing survey stations.
- 3.Running survey lines.

4. Explain the methods of scale

(i) **Engineer's scale:** If one cm on the plan represents some whole number of meters on the ground, such as 1cm = 10m. This type of scale is called Engineer's scale.

(ii) **Representative Fraction :** If, one unit of length on the plan represents some number of same units of length on the ground, such as 1/1000, etc. This ratio of map distance to the corresponding ground distance is independent of units of measurement and is called Representative Fraction.

(iii) **Graphical scale:**A graphical scale is a line sub-divided into plan distance corresponding to convenient units of length of the ground

5. What are the points to be considered while choosing the scale?

- a) Choose a scale Large enough so that in plotting or in scaling distance from the finished map, it will be not be necessary to read the scale closer than 0.25mm
- b) Choose as small a scale as a consisted with a clear delineation of the smallest detail to be plotted.

6. What are the types of Scales?

Scales used in surveying are

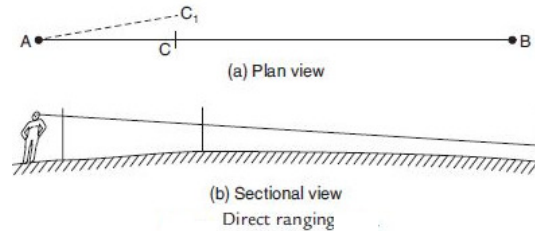
- (i) Plain scale.
- (ii) Diagonal scale.
- (iii) Vernier scale.
- (iv) Scale of chords.

7. Define Ranging (Mav/June2008).

The process of establishing intermediate points on a straight line between two end points is known as ranging.

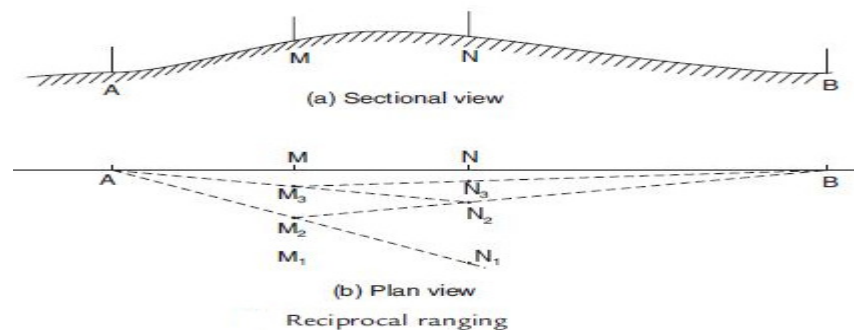
8. Define Direct Ranging?

Direct ranging is done when the two ends of the survey lines are intervisible. In such cases, ranging can either be done by eye or through some optical instrument such as a line ranger or a theodolite.



9. Define indirect or Reciprocal Ranging?

When the end stations are not intervisible either due to high intervening ground or due to long distance between them, intermediate ranging rods are fixed on the line in an indirect way. This method is known, as indirect ranging or reciprocal ranging.



10. Differentiate Accuracy and Precision?

Accuracy is the degree of perfection obtained.

Precision is the degree of perfection used in the instruments

11. Explain the sources of Errors in chain surveying? (May 2005)

(i) **Instrumental Error:** The Error due to, Imperfection in construction and adjustment of the instrument, The incorrect graduation. The improper adjustment of the plate level are called Instrumental Error.

(ii) **Personal Error:** The Error due to, Lack of perfection in human sight, Lack of perfection in and setting the instruments are called personal Error..

(iii) **Natural Error:** The Error due to Variations in Natural phenomena such as Temperature, humidity, gravity, refraction and magnetic declination are called Natural Error.

12. Define Chain Surveying?

It is the branch of surveying in which the distances are measured with a chain and tape and the operation is called chaining.

13. Define Main Station and sub station?

(i) **Main station:** A survey station is a prominent point on the chain line and can be either at the beginning of the chain line or at the end. Such station is known as main station.

(ii) **Tie Station (or) Sub Station:** It is a station on a survey line jointing two main stations. These

14. Define the following terms (May/June 2005)

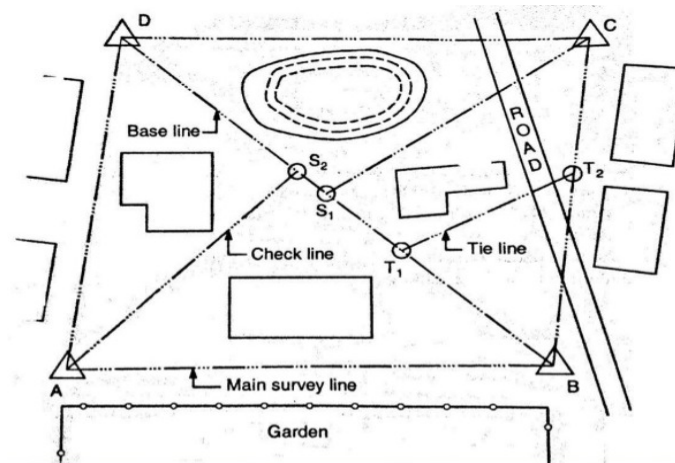
(i) **Main survey line:** The chain line joining two main survey stations is called main survey line tie line or Sub line. A chain line journey two tie station is called sub line. These are provided to locate the interior details.

(ii) **Base line:** It is longest main survey line on a fairly level ground and passing through the center of the area. It is the most important line as the direction of all other survey line is fixed with respect to this line.

(iii) **Check line:** Check line (or) Proof line is a line which is provided to check the accuracy of the field work.

(iv) **Offset:** It is distance of the object from the survey line. It may be perpendicular (or) oblique.

(v) **Chain age:** It is the distance of a well defined point from the starting point in chain survey. It's normally referred to as the distance of offset from the starting point on the chain age or chain line.



A, B, C, D is main station or boundary station

AS_2 = Check line.

BD = Base line

T_1, T_2 = Tie line.

15. What is Cumulative Error?

Cumulative Error: These are errors, which are liable to occur in the same direction and to accumulate. Therefore the actual length can be found by separating the error from measure.

These error may be caused an

- (i) The length of chain is shorted then the std length.
- (ii) Bending of links, knot's, links removal of links. During the adjustment of chain etc.
- (iii) Not applying slope correction to the length measured in the slopes.
- (iv) Not applying temperature correction. When temperature will churning measurement is different from temperature during calends.
- (v) bad range, bad starting and wrong lining.

16. Explain Compensative Error.

These are errors, which are liable to occur in both the direction and tend to compensate. Compensating errors are proportional to the square root of length of the line.

These errors may be caused due to,

- (i) Incorrect holding & marking of the arrows
- (ii) Incorrect plumbing while chaining on slopes.

17. State the Instruments used for setting perpendiculars.

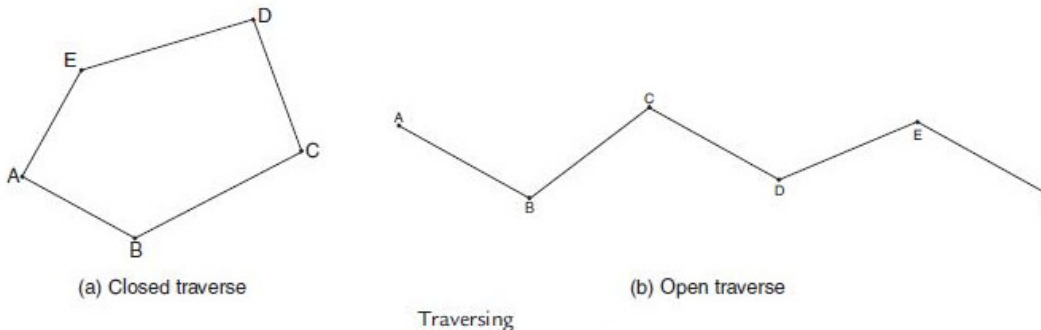
Instruments used for setting perpendiculars are

- (i) Cross staff
 - a) Open cross staff,
 - b) French cross staff,
 - c) Adjustable cross staff.
- (ii) Optical square,
- (iii) Prism square,
- (iv) Site square.

18. Define Traversing

Traversing is the type of survey, in which a number of connected survey lines form the framework and the directions and lengths of the survey lines are measured with the help of an angle measuring instrument and a chain or tape.

19. Define closed traverse and open traverse.



When the survey lines form a circuit which ends at the starting point, is called Closed Traverse. If the circuit ends elsewhere, it is called open traverse.

20. State the methods of Traversing.

- (i) Chain Traversing,
- (ii) Chain and compass traversing (loose needle method)
- (iii) Transit Tape Traversing:
 - (a) By fast needle method.
 - (b) By measurement of angles between the lines.
- (v) Plane –table traversing.

In this method the whole of the work is done with the chain and tape. No angle measuring instrument is used and the direction of lines are fixed entirely by linear measurements.

22. Define chain angles

In chain traversing, the angles fixed by linear or tie measurements are known as chain angles.

23. Define Well conditioned and Ill conditioned Triangles.(May/June 2008)

Well conditioned Triangle: A triangle is said to be well-conditioned when no angle in it less than 30degree or greater than 120degree

Ill conditioned Triangles: The triangles in which angle is less than 30° or more than 120° is said to be ill condition triangle.

24. Define Pantagraph.

Pantagraph is an instrument used for reproducing, enlarging and reducing the maps. It is based on the principle of similar triangles.

25. What is meant by geodetic surveying? (May/June2008)

In geodetic surveying, the curvature of the earth is taken into consideration. It is extended over a large area. The line joining any two points is considered as a curved line. The triangle formed by any three points is considered to be spherical and the angle of the triangle is assumed to be spherical angles. Geodetic surveying is conducted by the survey of India department, and is carried out over an area exceeding 250km².

26. What are offsets? Name the types. (Nov/Dec 2006)

The lateral measurement taken from an object to the chain is known as 'offset'. Offsets are taken to locate objects with reference to the chain line. They may be of two kinds (1) Perpendicular (2) oblique.

27. Define Scale (May/June 2008)

The ratio by which the actual length of the object is reduced or increased is known as the 'scale'

28. Distinguish between a check line and a tie line (Nov/Dec2006)

S.NO	CHECK LINE	TIE LINE
1	The line joining the apex point of a triangle to some fixed point on its base is known as the 'check line'	A tie line is a line which joints subsidiary or tie stations on the main line
2	It is taken to check the accuracy of the triangle sometimes this line helps to locate interior details	The accuracy in the location of the objects depends upon the accuracy in laying the tie line.

29. Define Compass Surveying.

The branch of surveying in which direction of survey line are determine by a compass and their length by a chain or tape is called compass surveying. This type of survey can be used to measure large areas with reasonable speed and accuracy.

30. What is a prismatic compass?

Prismatic compass is a instrument used to measure the bearing of a line. It consists of a magnetic needle pivoted at the center and is free to rotate. The area below the magnetic needle is graduated between 0 to 360 degrees. The instrument cover consists of a sighting vane and vertical hair to align the compass along the instrument station and the staff station.

A series of connected straight lines each joining two points is called traverse. Traverse may be either a closed traverse (or) open traverse. Traversing using compass is done by observing magnetic bearings of surrounding points from a point and shifting the point of observation along the traverse direction.

32. What is Fore and Back bearing?

The bearing of the line in the direction of progress of survey is called fore or forward bearing while the bearing opposite to the direction of the progress of survey is known as reverse of Back bearing.

33. What is closing error?

When a close traverse is plotted from the field measurements the ends stations of a traverse generally doesn't coincide exactly in the starting station.

This is due to the error in field observations such an error of traverse is known as closing error or error of closer.

34. What is local attraction? (Nov/Dec 2006)

A magnetic meridian at a place is determined by a magnetic needle which is uninfluenced by other attractive sometimes; the magnetic needle may be attracted and prevented from indicating the true magnetic meridian

Local attraction is a term used to denote and influence which prevents the needle from pointing to the magnetic north in a given locality.

35. What are the sources of local attractions? (Nov/Dec 2006)

The sources of local attraction are: Magnetic in the ground, wires carrying electric current, steel structures, rails, underground iron pipes, keys, steel –bowed spectacles metals buttons, axes, chains, steel tapes etc., which may be lying on the ground near by.

36. What is Dip?

When a magnetic needle is suspended freely it always points north. Due to certain factors magnetic needle may not point true north, it points at a direction away from north called magnetic north. The included angle between magnetic north and true north is called dip or declination.

37. Define true and magnetic meridian. (May/June 2005)

True meridian is the angle between the observed line and actual north. This is the bearing observed in the absence of local attraction or magnetic declination.

Magnetic meridian is the angle between the observed line and magnetic north. Magnetic north may deviate from true north due to local attraction or magnetic declination.

$$\text{True Meridian} = \text{Magnetic Meridian} \sim \text{Dip}$$

38. What is whole circle bearing?

In this method bearings of lines are observed from magnetic north and are observed directly from the prismatic compass.

39. What is Quadrental Bearing?

These are bearings of lines from north or south towards east or west. These values are usually reduced from observed whole circle bearing for the ease of calculation of included angles and plotting.

40. What is the difference between prismatic and surveyor's compass?

Sr. No.	Prismatic Compass	Surveyors Compass
1.	Graduation circle is fixed to broad type needle. Hence There is a prism at viewing end. It will not rotate with the line of sight.	Graduation circle is fixed to the box. Hence, it rotates with the line of sight.
2.	There is a prism at viewing end.	At viewing end there is no prism. There is only a slit.
3.	Sighting and reading can be done simultaneously.	Sighting and viewing cannot be done Simultaneously
4.	The magnetic needles do not act as an index.	Magnetic needle acts as index while reading
5.	The graduations are in whole circle bearing.	The graduations are in quadrantal system.
6.	Graduations are marked inverted since its reflection is read through prism.	Graduations are marked directly. They are not inverted.
7.	The reading is taken through a prism.	The reading is taken by directly viewing from top glass.
8.	Tripod may or may not be used. It can be held on a stretched hand also.	Tripod is essential for using it.

41. Define Level surface (May/June2008)

Level surface: It is defined as a curved surface which at each point is perpendicular to the direction of gravity at the point. Any surface parallel to the mean spheroidal surface of the earth is therefore a level surface.

42. Define the following terms

Level line: It is a line lying in a level surface and normal to the plumb line at all points.

Horizontal plane: A horizontal plane through a point is a plane tangential to the surface at that point.

Horizontal line: It is a line lying in the horizontal plane.

Vertical line: Vertical line any point is a line normal to the level surface through that point.

Vertical plane: A plane is a plane containing a vertical line.

Datum surface: It is any arbitrary assumed level surface form which vertical distances are measured.

43. Define the following terms.

Elevation: Elevation of a point is its vertical distance above or below the datum also known as reduced level (R.L)

Line of collimation: It is the line joining the intersection of the cross hairs to the optical center of the object glass and its continuation also known as line of sight.

Axis of telescope: It is the line joining optical center of the object glass to the center of the eyepiece.

Vertical axis: It is the center line of the axis of rotation.

44. Define the following terms

Back sight (B.S): It is a staff reading taken on a point of known elevation (i.e.) on Bench Mark or change point, and is the first reading taken after the level is set up and leveled.

Fore sight (F.S): It is a last staff reading on a point whose elevation is to be determined as on a change point.

Intermediate sight: It is any other intermediate staff reading taken on a point of unknown elevation from the same set of the level.

45. Define change point

It is a point denoting the shifting of the instrument. It is a point on which the back and foresights are taken.

46. What is meant by height of collimation? (Nov/Dec2006)

When the leveling instrument is properly levelled, the R.L of the line of collimation is known as the height of instrument. This is obtained by adding BS reading to the R.L of the BM or CP on which the staff reading was taken.

47. Define levelling

It is a method of surveying in which the relative vertical heights of the points are determined by employing by level under graded staff.

48. Define Sensitivity of level tube

The ability of level tube to express small deviation from the horizontal axis is termed as sensitivity of level tube.

49. Difference between a level line and horizontal line. (May/June2007)

LEVEL LINE	HORIZONTAL LINE
Any line lying on a level surface is called a level line. This line is normal to the plump line at all points	Any line lying on horizontal plane is said to be a horizontal line. It is a straight lint tangential to the level line,

50. What are the different kinds of bench marks? (Nov/Dec2007)

Bench marks may be of four types.

1. GTS bench marks
2. Permanent bench marks
3. temporary bench marks
4. Arbitrary bench marks

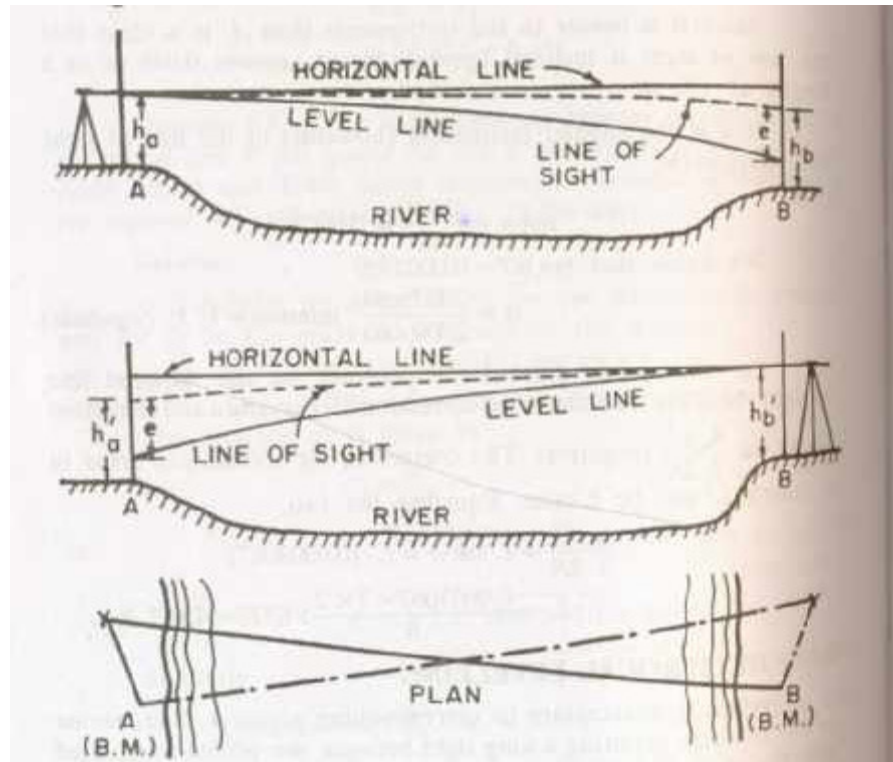
51. What is method of reiteration? (Nov/Dec 2008)

Reiteration method is suitable for the measurement of the angles of a group having a common vertex point. Several angles are measured successively and finally the horizon is closed.(closing the horizon is the process of measuring the angles around a point to obtain a check on their sum, which should equal 360 degree.

52. What is reciprocal levelling? (Nov/Dec2006)

The level is placed exactly midway between two points and staff readings are taken to determine the difference of level, then the errors (due to inclined collimation, curvature and refraction) are automatically eliminated.

But in the case of river or valley, it is not possible to set up the level midway between two points on opposite banks. In such cases, the method of reciprocal levelling is adopted, which involves reciprocal observations from both banks of the river or valley.



53. What is meant by barometric levelling? (May/June 2008)

The barometric levelling is based on the fact the atmospheric pressure varies inversely with the height. As air is a compressible fluid, strata at low level will have a greater density than those at a higher altitude. A barometric is used for the determination of the difference in pressure between two stations and their relative altitudes can then be approximately deduced.

The average reading of the barometer at sea level is 30 inch and the barometer falls about 1 inch for every 900feet of ascent above sea level.

54. What is meant by bench mark? (May/June 2008)

These are fixed points or marks of known RL determined with reference to the datum line. These are very important marks. These serve as reference points for finding the RL of new points or for conducting leveling operations in projects involving roads, railways etc.

55. Distinguish between GTS bench mark and arbitrary bench mark (April/May 2008)

GTS BENCH MARK	ARBITRARY BENCH MARK
These bench-marks are established by the survey of India department at a large interval all over the country. The values of reduced levels, the relevant positions and the number of bench marks are given in a catalogue published by this department	When the reduced levels of some fixed are assumed, they are termed arbitrary bench marks. These are adopted in small survey operations when only the undulations of the ground surface is required to be determined

56. What is fly leveling?

The leveling operation in which only BS and FS readings are taken and no intermediate sights are observed is known as fly leveling.

57. What is check leveling?

In case of longitudinal leveling, at the end of the day's work, the finishing point is connected to the starting point of that day's by fly leveling, to check the accuracy of the work. This operation is called check levelling

58. Briefly explain the temporary adjustments of a level.

Temporary adjustments are done before the beginning of the survey and after each shifting of the instrument.

(i) Centering of bubble to align the line of sight horizontal using foot screws. This should be checked often since slight disturbance of the instrument affects the line of sight to a large extent.

(ii) Focusing of telescope to a distant object

(iii) Adjustment of eye piece to have a clear view of the cross hairs

59. Name the sources of errors in leveling.

Errors in leveling may be categorized into

- a. Personal error
- b. Errors due to natural factors and
- c. Instrumental error

60. Define analytic lens.

The vertex of the measuring triangle falls at the exterior principal focus of the objective and not at the vertical axis of the instrument. In 1840, porro devised the external focusing anallactic telescope, the special feature of which is an additional lens, is called an anallactic lens.

61. Write down the prismoidal formula for finding out the volume using a contour map. (May/June 2007)

Volume (Cutting or filling) $V = d/3(A_1 + A_n + 4(A_2 + A_4 + A_{n-1}) + 2(A_3 + A_5 + \dots + A_{n-2}))$

Where, A_1, A_2, \dots, A_n are the areas enclosed by various contours.

d = contour interval.

62. What is meant by a contour? (Nov/Dec 2008)

A contour is an imaginary line on the ground joining the points of equal elevation. It is a line in which the surface of ground is intersected by a level surface.

63. What is meant by contour interval? (May/June 2008)

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

64. What is a contour gradient? (April/May 2008)

Contour gradient is a line lying throughout on the surface of the ground and preserving a constant inclination to the horizontal. If the inclination of such a line is given, its direction from a point may be easily located on the map or on the ground.

65. What is trigonometric levelling?

Trigonometrical levelling is the process of determining the differences of elevations of stations from observed vertical angles and known distances, which are assumed to be either horizontal or geodetic lengths at mean sea level. The vertical angles may be measured by means of an accurate theodolite and the horizontal distances may either be measured (in the case of plane surveying) or computed (in the case of geodetic observations).

66. Define geodetic surveying

The object of the geodetic surveying is to determine very precisely the relative or absolute positions on the earth's surface of a system of widely separated points. The relative positions are determined in terms of the lengths and azimuths of the lines joining them. The absolute positions are determined in terms of latitude, longitude, and elevation above mean sea level. However, the distinction between geodetic surveying and Plane surveying is fundamentally one of extent of area rather than of operations.

67. What is triangulation?

In triangulation, the system consists of a number of inter-connected triangles in which the length of only one line, called the base line, and the angles of the triangles are measured very precisely. Knowing the length of one side and the three angles, the lengths of the other two sides of each triangle can be computed.

68. What are the disadvantages of using triangulation?

The defect of triangulation is that it tends to accumulate errors of length and azimuth, since the length and azimuth of each line is based on the length and azimuth of the preceding line. To control the accumulation of errors, subsidiary bases are also selected. At certain stations, astronomical observations for azimuth and longitude are also made. These stations are called Laplace Stations.

69. What are the objects of Geodetic Triangulation?

➤ To provide the most accurate system of horizontal control points on which the less precise triangles may be based, which in turn may form a framework to which cadastral, topographical, hydrographical, engineering and other surveys may be referred.

➤ To assist in the determination of the size and shape of the earth by making observations for latitude, longitude and gravity.

70. What is a well-conditioned triangle?

There are various triangulation figures and the accuracy attained in each figure depends upon (i) the magnitude of the angles in each individual triangle, and (ii) the arrangement of the triangles. Regarding (i), the shape of the triangle should be such that any error in the measurement of angle shall have a minimum effect upon the lengths of the calculated side. Such a triangle is then called well-conditioned triangle.

In a triangle, one side is known from the computations of the adjacent triangle. The error in the other two sides will affect the rest of the triangulation figure. In order that these two sides be equally accurate, they should be equal in length. This can be attained by making the triangle isosceles.

71. Name the corrections to be made to the base line of a triangulation network.

After having measured the length, the correct length of the base is calculated by applying the following corrections:

- Correction for absolute length
- Correction for temperature
- Correction for pull or tension
- Correction for sag
- Correction for slope
- Correction for alignment
- Reduction to sea level.

72. What is a Satellite station?

In order to have well conditioned triangles or for better visibility, objects such as church spires, flag poles, towers, etc. are sometimes selected as triangulation stations. When the observations are to be taken from such a station, it is impossible to set up an instrument over it. In such a case, a subsidiary station, known as satellite station or eccentric station or false station is selected as near to the main station and observations are taken from the satellite station and corrections applied.

73. What is reduction to center?

The angle measured from satellite stations has to be corrected to what they would have been if they were measured from the true station. The operation of applying correction due to the eccentricity of the station is generally known as reduction to center.

74. What is a bench mark?

Bench mark is a relatively permanent point of reference whose elevation with respect to some assumed datum is known. It is used either as starting point for leveling or as a point upon which to close a check.

75. What is a Traveller?

A traveler is a special type of boning rod in which the horizontal pieces can be moved along a graduated

76. Define Independent Quantity.

An observed quantity may be classified as (i) independent and (ii) conditioned. An independent quantity is the one whose value is independent of the values of other quantities. It bears no relation with any other quantity and hence change in the other quantities does not affect the value of this quantity. Example: reduced levels of several bench marks.

77. Define Conditioned Quantity.

A conditioned quantity is the one whose value is dependent upon the values of one or more quantities. Its value bears a rigid relationship to some other quantity or quantities. It is also called a dependent quantity. For example, in a triangle ABC, $\angle A + \angle B + \angle C = 180^\circ$. In this conditioned equation, any two angles may be regarded as independent and the third as dependent or conditioned.

78. Define Direct Observation.

An observation is the numerical value of a measured quantity, and may be either direct or indirect. A direct observation is the one made directly on the quantity being determined, e.g., the measurement of a base, the single measurement of an angle etc.

79. Define Indirect Observation.

An indirect observation is one in which the observed value is deduced from the measurement of some related quantities, e.g., the measurement of angle by repetition (a multiple of the angle being measured.)