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BASIC CIVIL AND MECHANICAL ENGINEERING (23ES1T01)

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UNIT II - Surveying

Syllabus: Objectives of Surveying- Horizontal Measurements - Angular Measurements- Introduction to Bearings Leveling instruments used for leveling -Simple problems on leveling and bearings - Contour mapping.

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1. Define what is meant by surveying and its objectives?

ANS:

Surveying (Definition): Surveying is the art of and science of determining the relative positions of various points or stations on the surface of the earth by measuring the horizontal and vertical distances, angles, and taking the details of these points and by preparing a map or plan to any suitable scale.

Objectives of surveying

The primary object of a survey is the preparation of a plan map. A plan is a representation of the ground and the objects upon it on some scale as projected on a horizontal plane. If the scale is large, then it is called a plan, if the scale is small, then it is called a map. Example: a plan of a building, a map of India.

Following are some of the purposes of survey:

- ✓ To prepare archeological maps, geological maps, military maps etc.
- ✓ To establish boundary points of properties with reference to the available records and demarcate ownership.
- ✓ To measure quantities in cutting or in embankments using contour maps.
- ✓ To lay out the alignment of engineering structures such as roads, railways etc.
- ✓ To plot profile of a structure(eg. irrigation canal) for ascertaining the carrying capacity of canal, capacity of reservoir etc
- ✓ To determine the relative position of points with reference to a known bench mark (eg. position of hill stations with reference to mean sea level).
- ✓ To measure distance between various points (eg. distance between two cities).

Survey may be primarily divided into two divisions.

1. Plane surveying: The plain surveying is that type of surveying in which earth surface is considered as a plane. In such surveying a line joining any two stations is considered to be straight. The triangle formed by any three points is considered as a plane triangle.

Surveying is carried out for a small area of less than 250 km^2. It is carried out by local or state agencies like R & B department, Irrigation department, and Railway department.

2. Geodetic surveying: The geodetic Surveying is that type of surveying in which the curvature of the earth is taken into account. It is generally extended over larger areas. The line joining any two stations is considered as curved line. The triangle formed by any three points is considered to be spherical and the angles of the triangle are considered to be spherical angles.

Geodetic surveying is conducted by the survey of India Department and is carried out for a larger area exceeding 250 km^2.

The surveying may be used for following purposes:

- ➢ To prepare a topographical map which shows hills, valleys, rivers, forests, villages, towns etc.
- ➢ To prepare a cadastral map which shows the boundaries of fields, plots, houses and other properties.
- ➢ To prepare an engineering map which shows the position of engineering works such as buildings, roads, railways, dams, canals.
- ➢ To prepare a contour map to know the topography of the area to find out the best possible site for roads, railways, bridges, reservoirs, canals, etc.
- ➢ Surveying is also used to prepare military map, geological map, archaeological map etc.
- ➢ For setting out work and transferring details from the map on the ground

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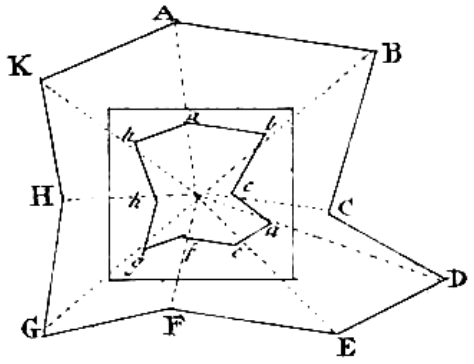
2. Explain the principle of surveying?
ANSWER:
All surveying works are based on two fundamental principles they are:
1. Working from whole to part: In order to prevent accumulation of errors and to localize the minor errors, a set of primary central points are established first with higher precision in and around the area to be surveyed. Later on, in between those primary control points, inner control points are established with less precision method. The details are surveyed with the help of these inner control points, adopting any one method of surveying. This principle is known as working from whole to part.



2. Fixing a point with reference to two fixed points: Consider any two points A and B. Let it be required to locate or mark a point 'C'. The relative position of the point C is located with reference to the two fixed points A and B by one of the following methods.
a) Liner measurement
b) Angular measurement
c) Both liner and angular measurements

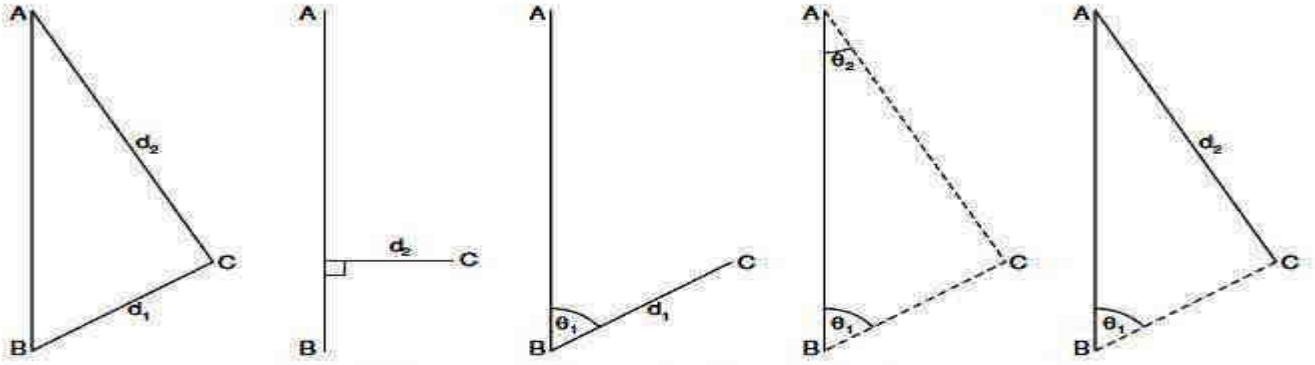


Fig. 11.3. Locating point C w.r.t. points A and B

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3. Write about classification of surveying and Types of Chain in Surveying?
ANSWER:
Classification of surveying:
According to the instruments used, the surveying is classifieds follows:

- ✓ Chain surveying
- ✓ Compass surveying
- ✓ Theodolite surveying
- ✓ Plane table surveying
- ✓ Tachometric surveying

Types of Chain in Surveying
Relying on the extent of the chain, these are distributed into the following categories. These are the types of chains in surveying:
1. Gunter's chain or surveyor's chain

2. Revenue chain
3. Metric chains
4. Engineer’s chain
5. Steel band or Band chain

S.No.	Type of chain	Length of chain	Number of links
1.	Revenue chain	33 ft	16 links
2.	Gunter’s chain	66 ft	100 links
3.	Engineer’s chain	100 ft	100 links
4.	Metric chain	20 m	100 links
		30 m	150 links

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4. Discuss in detail about chain surveying?

ANSWER

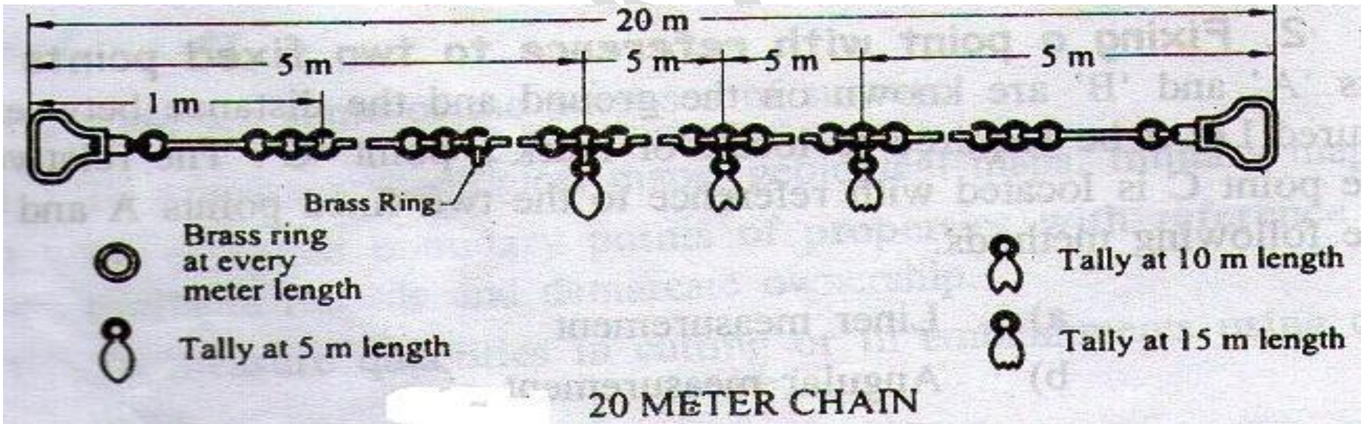
Instruments used for chain surveying:

The various instruments used in chain surveying are as follows.

1. chain
2. arrows
3. pegs
4. ranging rods
5. offset rods
6. plumb bob

1. Chain:

Chains are used to measure horizontal distances. Chains are formed of straight links of galvanized mild steel wire called links. The ends of each link are bent into a loop hand connected together by means of three oval rings which afford flexibility to the chain.



The chain s made of mild steel. The ends of the chin are provided with brass handles for dragging the chain on the ground. The outside of the handle is the zero point. Metallic tags are indicators of the chain to facilitate quick reading of fraction of a chain in surveying measurements. Metric survey chains are available in lengths of 20m/ 65ft and 30m/100ft. The 20m chain contains 100 links whereas 30m chain contains 150 links. One link of both the type of chain measure 20cm.

2. Arrows

Arrows or making pins are made of tempered steel wire 4mm in diameter and generally 10 arrows are supplied with a chain. An arrow is inserted into the ground after the chain length is measured on the ground. Usually the length of an arrow is 40cm.

3. Pegs

Wooden pegs are used to mark the positions of the stations terminal points of a survey line. They are made of hard timber, generally 2.5cm or 3 cm square and 15cm long, tapered at the end.

4. Ranging Rods

The ranging rods are used for making the positions of stations and for ranging the lines. They are made of all seasoned straight grained timber teak. They circular in cross section of 3cm diameter and have a length of 2 or 3cm, length being more common. They are shod at the bottom with a heavy iron points. In order to make them visible at a distance, they are pained alternatively black and white or red and white.

5. Offset

Offset rod is similar to that of ranging rod. They are should with pointed iron shoe at one end, ad provided with a notch or a hook at the other for pulling or pushing the chain through a hedges or other obstructions.

6. Plumb Bob

While chaining along sloping ground, a plump is required to transfer the points to the ground. It is also used for accurate centering of the Theodolite compass, plane table etc over a station mark and for testing the vertically of ranging poles.

7. Cross staff

This is the instrument used for setting out right angles to a chain line. It consists of either a frame or box with two pairs of vertical slits and is mounted on a pole shod for fixing in the ground.

- ✓ Open cross staff
- ✓ French cross staff
- ✓ Adjustable cross staff

Advantages and Disadvantages of chain surveying

Advantages:

- ✓ Chain surveying is suitable for fairly level ground
- ✓ It does not require costly equipments
- ✓ It is used for preparing plans of smaller area
- ✓ It is simple

Disadvantages

- ✓ It is cannot used for large areas
- ✓ It is not always accurate

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5. Discuss about different types of Tapes used in surveying

ANSWER:

There are several types of tapes commonly used in surveying:

1. Steel tapes

- ➢ Steel tapes are known for their accuracy and their longevity.
- ➢ They don't stretch easily and give accurate readings over long distances.
- ➢ In measuring, steel tape comes in different lengths, usually from 10 metres to several hundred metres.

2. Fibre glass tapes

- ➢ Fibreglass tapes are thin and can be bent to any form.
- ➢ They are easy to move around and handle.
- ➢ They are often used to measure small distances and are less affected by changes in temperature.
- ➢ Fibreglass tapes can be used to measure small distances, usually between a few metres and about 100 metres.

3. Cloth tapes

- ➢ Cloth tapes are made of cloth and are usually used for rough measurements or when accuracy is not as important.
- ➢ They are cheaper than steel or plastic tapes, but they are not as accurate.
- ➢ Most of the time, cloth tape is used in surveying to measure small distances.

4. Invar tapes

- ➢ Invar tapes are made of a rare metal alloy called invar. Invar has a low rate of thermal expansion.
- ➢ In surveying, Invar tape is used because it is very accurate and doesn't change with temperature.
- ➢ This makes it good for making accurate measures over long distances.

5. Electronic Distance Measurement (EDM) Tapes

- EDM tapes are made of steel or fiberglass tape and an electric device that can measure distance.
- These tapes have a wire or cable built into them that can send electrical signals. This makes it easier and more accurate to measure distances.
- Most of the time, EDM tapes are used with electrical tools like total stations.

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6. Discuss about compass survey and the instruments used for compass survey?

Answer

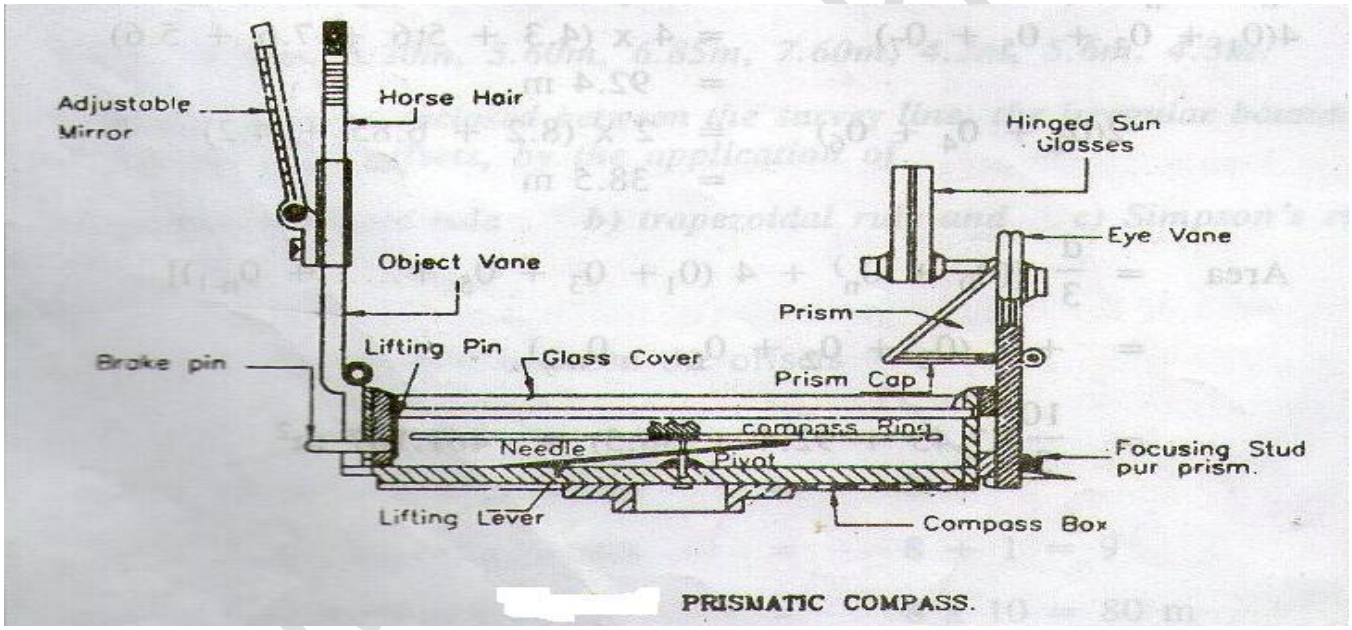
Compass survey

When the area to be surveyed is large, chain and compass surveying is preferable. A compass is used to measure the magnetic bearing of a line. There are two forms of compass that are commonly used.

1. The prismatic compass and 2. The surveyors compass.

1. The prismatic compass: It is circular in shape and its diameter varies from 85 mm to 110 mm. A pivot is provided at the centre of the box. It carries a magnetic needle. The needle is attached to an aluminum ring which is graduated to 1/2. A light spring break is attached to the inside of the base to damp the oscillations of the needle and bring it to rest before taking a reading.

A reflecting prism facilitates reading of the angles and is protected from moisture and dust etc by a prism cap. The prism base and vertical facts are made convex which magnifies the readings. The object vane is located diametrically opposite to the prism. It is hinged to the side of the box and carries a horse hair. A title reflecting mirror is provided on the side of the object vane to enable bearing of very high or low objects to be taken. A metal cover is provided to enclose the compass and the object vane.



PRISMATIC COMPASS.

2. Surveyor's compass: Surveyor's compass resembles the prismatic compass but with a slight difference. The graduated card is attached to the box and North 90 at south and at East and West interchanged.

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7. Discuss about different methods of using prismatic compass?

ANSWER:

The compass is usually mounted on a light tripod which carries a vertical spindle in a ball and socket joint which the box is screwed. By means of this arrangement, the instrument can be quickly leveled and also rotated in a horizontal plane and clamped in any position.

Centering: The compass should be centered over the station where the bearing is to be taken. This is done by dropping a small piece of stone from the centre of the compass so that it falls on the top of the peg marking the station (or by using plumb bob) and by adjusting the legs of the tripod.

Leveling: The compass should then be leveled by eye, by means of a ball and socket joint so that the graduated ring may swing quite freely. It should be clamped when leveled.

Bearing: A ranging rod is kept at the next station. The compass is turned until the ranging rod at the station is bisected by the hair when looked through the slit above the prism. When the needle comes to rest, by pressing the knob if necessary, the reading is noted at which the hair line appears to out the image of the graduated ring. The sighting of the ranging rod and the reading is done simultaneously. The reading gives the bearing of the line.

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8. Define true bearing, magnetic bearing and arbitrary bearing?

ANSWER:

The bearing of a line is its orientation in relation to a specific meridian. Meridians are imaginary lines of longitude that run from the North Pole to the South Pole. A principal meridian is a reference line used to survey a large area.

The types of Bearing in Surveying works with respect to different meridians are as follows:-

1. True Bearing in surveying works

True Meridian- A true meridian along a line is defined as a line along which a plane aligns with the earth's surface after passing through the true north and south extremes. As a result, it traverses both, the true north and the true south. Astronomical studies can be used to determine the path of the true meridian through a point.

True Bearing- A line's true bearing is the horizontal angle it forms with the true meridian through one of its extremities. Because the true meridian through a point remains constant, the true bearing of a line is a constant quantity.

2. Magnetic Bearing in Surveying Works

Magnetic Meridian- The direction shown by a freely floating and balanced magnetic needle free of all other attractive forces is the magnetic bearing through a point. A magnetic compass can be used to determine the magnetic meridian's direction.

Magnetic bearing- The magnetic bearing of a line is the horizontal angle formed by the magnetic meridian passing through one of the line's extremities. To measure it, a magnetic compass is used.

3. Grid Bearing in Surveying Works

A grid meridian is one that runs parallel to the central true meridian for a specific area covered by a plane coordinate system. A grid bearing is determined by using the direction northwards along the grid lines of the map projection as a reference point. The grid lines are chosen to be parallel to the meridians and perpendicular to the parallels.

The grid bearing of a line is the horizontal angle formed by a grid line running through one of its extremities. By subtracting or adding 35° from the grid bearing, the true bearing and magnetic bearing are calculated.

4. Arbitrary Bearing in Surveying Works

An arbitrary meridian is any convenient direction towards a permanent and significant mark or signals, such as a church spire or the top of a chimney. These meridian lines are used to compute the relative positions of lines in a small area.

Arbitrary Bearing- The horizontal angle formed by a line with any arbitrary meridian at one of its extremities. A Theodolite is used to measure it.

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9. What is meant by "bearing of line", designation of bearing, fore bearing and back bearing?

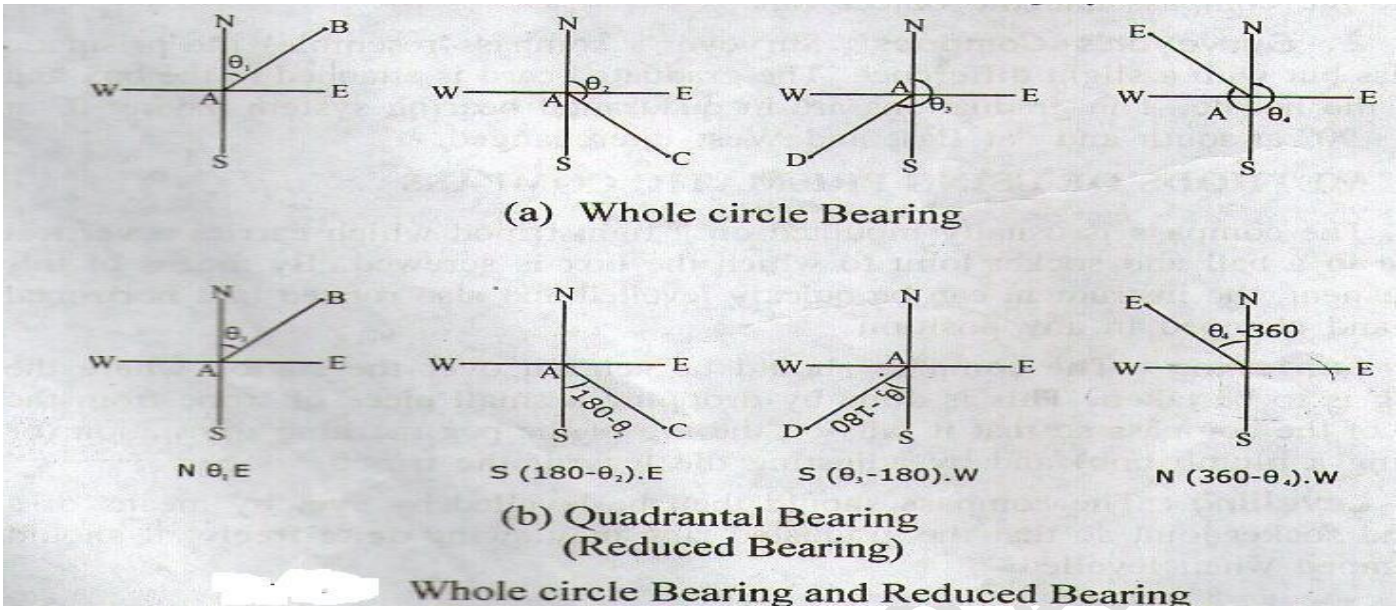
ANSWER

The bearing of a line is the horizontal angle made by the line with a selected reference line called the meridian. There are two types of bearings.

i) Magnetic Bearing: The direction indicated by a freely supported magnetic needle unaffected by local attractive forces, is called the magnetic meridian. The angle between any line and magnetic meridian is called magnetic bearing or simply bearing.

ii) The bearing of azimuth: The line joining the geographical north and south poles is known as the true meridian or geographical meridian. The angle between any line and the true meridian is called true bearing of azimuth.

DESIGNATION OF BEARING



Whole circle Bearing and Reduced Bearing

1. The whole circle bearing system:

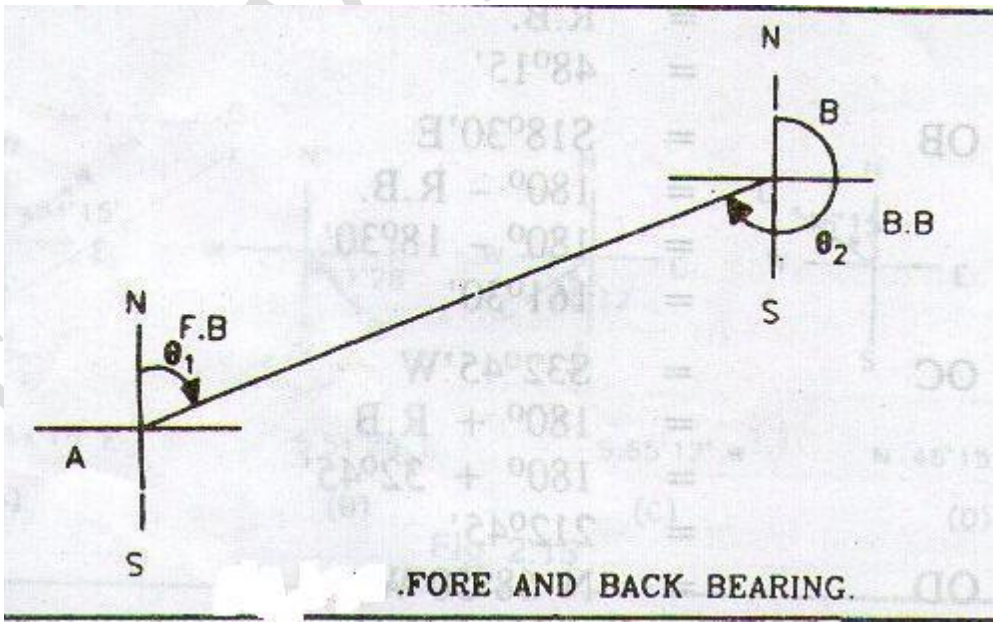
In this system the bearing of a line is measured with north in clockwise direction. The value of the bearing thus varies from 0^o to 360^o.

2. Quadrantal bearing system

In this system the bearing of a line measured from either the north or the south, clockwise or counter clockwise whichever is nearer the line, towards the east or west

Fore bearing and back bearing

In compass surveying, two bearings are observed for each line, one from each end of the line. The bearing of a line in the direction of the progress of survey is called "forebearing" while the bearing measured in the opposite direction is known as "back bearing". For e.g. the bearing of line AB taken from the point A is the fore bearing of line AB and the bearing from point B is back bearing of the line AB.



.FORE AND BACK BEARING.

Fore Bearing (F.B)

i) Fore bearing is the bearing of the line in the forward direction of surveying.

ii) The formula used to calculate the fore bearing of the progressive line F.B = B.B ± 180° { + sign when B.B less than 180° and – sign when B.B more than 180°}.

Back Bearing (B.B)
i) Back bearing is the bearing of the line in the opposite direction of surveying.
ii) The formula used to calculate the back bearing of line B.B = F.B ± 180° { + sign when F.B less than 180° and – sign when F.B more than 180°

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10. What is meant by "Theodolite survey" and how we use the instrument for survey?

ANSWER

The Theodolite is the most precise instrument used for measurement of horizontal and vertical angles. It can also be used for various surveying operations such as establishing grades, setting out curves, extending survey lines, determining differences in elevation etc.

Two categories classified:
1. Transit Theodolite
2. Non-transit Theodolite

Essential parts of a transit Theodolite are given below

1. Telescope:
A Theodolite is provided with a telescope to sight the distant objects clearly. It is mounted on a spindle known as horizontal axis

2. Two spindles:
There are two spindles with axes one inside the other. The outer axis is hallowed and its interior is ground conical to fit the central vertical axis which is a solid and conical.

3. Lower plate:
The outer axis is attached to the lower plate also called the scale plate, having its edge beveled. The edge is silvered and graduated from 0^o to 360^o in the clockwise direction. The lower plate is provided with a clamped tangent screw or the slow motion screw by means of which it can be fixed at any desired position

4. Upper plate:
The upper plate also called the vernier plate is attached to the inner axis. A clamp and a tangent or slow motion screw are provided for the purpose of accurately fixing the vernier plate to the scale plate. When both plates are clamped together and the lower clamp or loosened, the instrument can be rotated about its outer axis; while if lower plate be clamped and the vernier plate be loosened, the instrument can be rotated about the inner axis. Before either of the tangent screw is turned, the corresponding clamp must be tightened.

5. Level Tubes:
Two spirit levels called placed at right angles to each other are fixed on the upper surface of the venires plate for leveling in the instrument.

6. Vertical circle:

The vertical circle and graduated and is attached to the horizontal axis of the telescope and thus it rotates with the telescope. The circle is graduated either continuous from 0^o to 90^o. By means of vertical clamp and tangential screw, the telescope can be set accurately at any position in vertical plane.

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11. What are the different types of levelling staff? State the functions?

ANSWER

A levelling staff is a straight rectangular rod having graduations, the foot of the staff representing zero reading. The purpose of a level in to establish a horizontal line of sight. The purpose of the levelling staff is to determine the amount by which the station is above or below the line of sight.

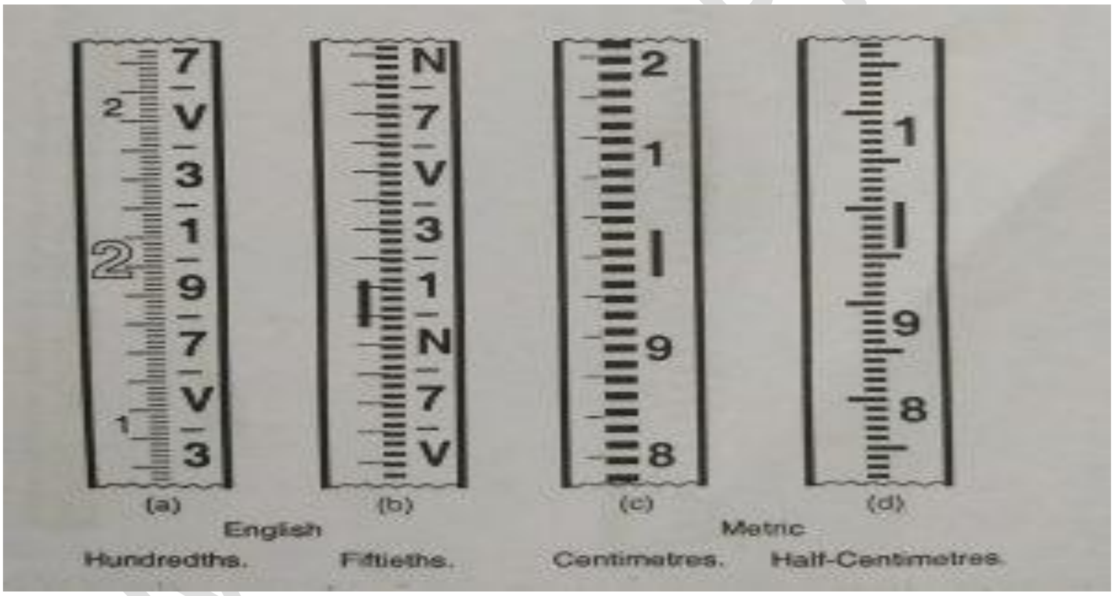
Types of Levelling staves may be divided into two classes

1. Self-reading staff
2. Target staff

A self-reading staff is the one which can be read directly by the instrument man through the telescope. A target staff, on the other hand, contains a moving target against which reading is taken by staff man.

1. Self-reading staff

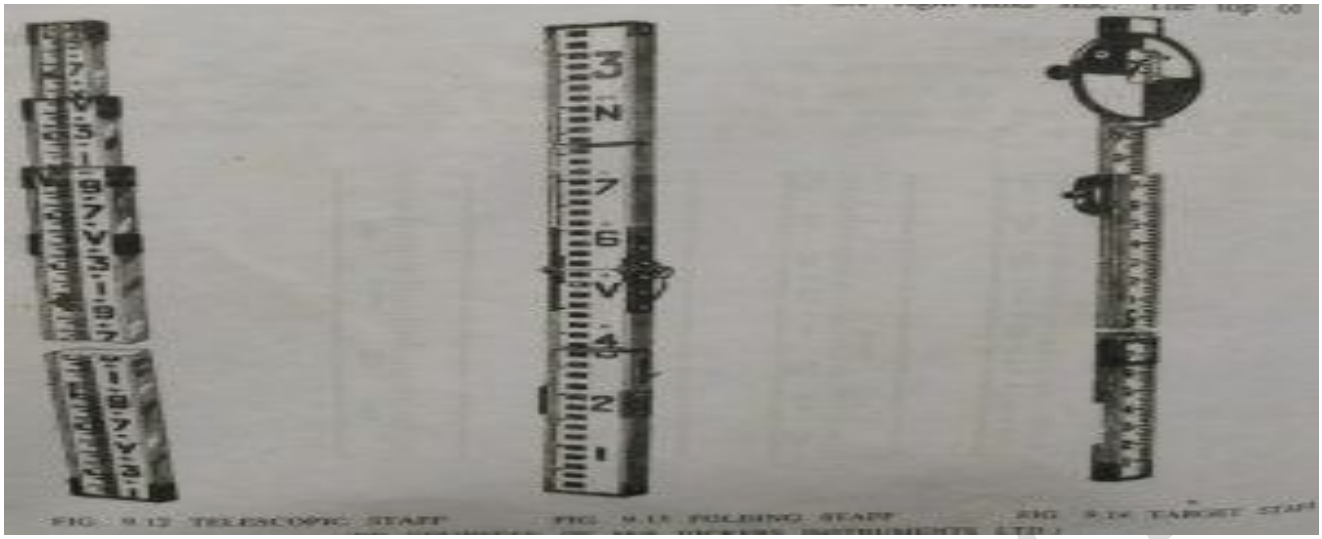
There are usually three forms of self-reading staff. They are solid staff, folding staff and telescopic staff. The figure below (a) and (b) show the pattern of solid staff in English units while (c) and (d) show that in the metric unit. The most common form of the smallest division is of 0.01ft or 5mm. However, some staves may have fine graduations up to 2mm. The staff is generally made of well-seasoned wood having a length of 10 feet or 3 metres.



The figure below 9.12 shows a Sopwith pattern staff arranged in three telescopic lengths. When fully extended, it is usually of 14ft length.

Fig below 9.13 shows a folding staff usually 10ft long having a hinge at the middle of its length. When not in use, the rod can be folded about the hinge so that it becomes convenient to carry it from one place to other.

Since a self-reading staff is always seen through the telescope, all readings appear to be inverted. The readings are, therefore, taken from above downwards.



2. Target Staff

Target staff is another type of levelling staff. Fig 9.14 shows a target staff having a sliding target equipped with vernier. The rod consists of two sliding lengths, the lower one of approx 7ft and the upper one of 6 ft. The rod is graduated in feet, tenths and hundreds and the vernier of the target enable the readings to be taken up to a thousand part of a foot.

For taking reading the level man directs the staff man to raise or lower the target till it is bisected by the line of sight. The staff holder then clamps the target and takes the reading.

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12. Define "Leveling", List out methods of levelling and explain?

ANSWER

Levelling in surveying is primarily used to determine the relative height of various points on, above, and below the ground's surface. It is a method of calculating the difference in elevations or levels between two points on the earth's surface. Distance is always measured from a reference point with known parameters (elevation, height above MSL, etc.). This aspect of vertical distance measurement is referred to as levelling in surveying.

Objectives of Levelling in Surveying

- To calculate the elevation of the given points with respect to the datum or reference line that has been provided or assumed.
- To establish the points with respect to a given or assumed datum at a given elevation or at various elevations.

Methods of Levelling in Surveying

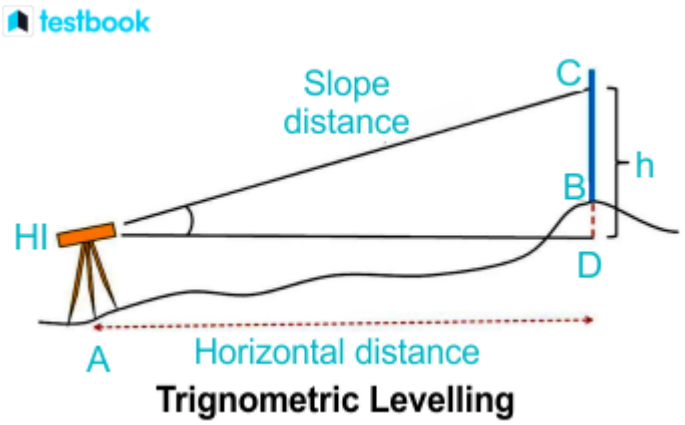
There are several methods of levelling in surveying to determine the elevation of various points. Let's look at them one by one :

1. Direct Levelling in Surveying

This is the most common type of levelling in surveying. In this method, a spirit level fixed to the telescope of a levelling instrument is used to make the line of sight horizontal. Then all the vertical distances are measured with respect to this horizontal line of sight. These vertical distances are used to determine the difference in elevations of various points. Spirit levelling is another name for direct levelling.

2. Trigonometric Levelling in Surveying

Trigonometric levelling is one of the indirect methods of levelling. This is the method of levelling in which the difference in elevations is determined indirectly from the horizontal distance and the vertical angle. As the trigonometric relations are used to determine the elevations, the method is called trigonometric levelling. Trigonometric levelling is employed when the direct method on the ground becomes cumbersome. For example, when we have to find the elevation of a mountain peak, top of towers, etc.



Trignometric Levelling

- **Simple Levelling:** This is the easiest type of direct levelling. In this method, only one setting of the instrument is done. This method is used for determining the difference of elevations of two points which are visible from a single position of the instrument.
- **Differential Levelling:** It is a type of levelling which requires more than one setting of the instrument. This method is used when the two points whose difference of elevation is required are situated quite apart. Differential levelling is also called compound levelling.
- **Check Levelling:** It is a type of differential levelling done to check elevations which have already been obtained. Generally, check levelling is done at the end of each day's work from the last station to the starting station (of that day) for checking that day's work. Instead of returning to the starting station, the day's work is sometimes checked by connecting the last station to the point of known elevation or with a B.M.
- **Fly Levelling:** It is a type of differential levelling in surveying done to determine approximate elevations of different points. The fly levelling is done where rapidity, but low precision is required. Fly levelling is generally used for the reconnaissance of the area or for approximate checking of the levels.
- **Profile Levelling:** It is a type of differential levelling done to determine the elevations of the ground surface along a fixed line. Profile levelling is also called longitudinal levelling. The levels obtained in profile levelling are used for plotting the longitudinal section, which is required for various purposes such as fixing the gradients, determining the earthwork quantities etc.
- **Cross-section Levelling:** This is also a type of differential levelling method. It is done to determine the difference of the ground surface along the line perpendicular to the centerline of the proposed road.
- **Reciprocal Levelling:** It is a method of levelling in surveying used to determine the difference in elevations of the two points which are situated quite apart, and it is not possible to set up the instrument midway between these points. For example, if the two points are located on the opposite banks of a river, pond, or valley, it would not be possible to set up the instrument in between them. The difference in elevations between these two points is determined by reciprocal levelling, by first setting up the instrument at one bank and holding the staff at the other bank and then interchanging the positions of the staff and the instrument.
- **Precise Levelling:** Being a very precise method of differential levelling, this method is employed when important work is to be carried out.

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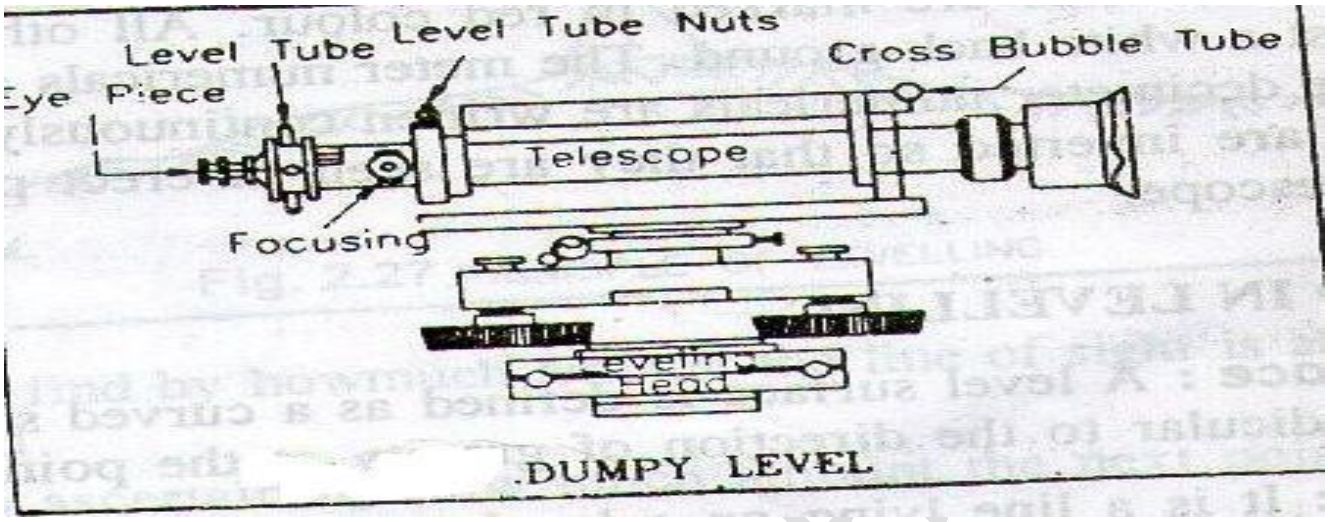
13. Discuss in briefly about DUMPY level?
ANSWER
Dumpy level:
The telescope is rigidly fixed with the support and therefore, can neither be rotated about the longitudinal axis, nor can it be removed from its support. A long bubble tube is attached to the top of the telescope. The leveling head generally consists of two parallel plates with either three foot screws of four foot screws. The upper plate is known as tribench and the lower plate is known as trivet which can be screwed on a tripod



Principle of leveling
When the level is set up correctly and leveled the line of collimation will be horizontal telescope is rotated about is its vertical axis it will revolve in a horizontal plane known as the plane of collimation and therefore, all staffs readings taken with the will be the vertical measurements made downwards from this plane.
To find by how much amount the line of sight is above the bench mark and to ascertain by how much amount the next point is below or above the line sight.
Height of instrument= Elevation of B.M + Back sight
Elevation of point B = Height of instrument – Foresight
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14. Write a short note on Plane table survey?
ANSWER
Plane table survey is that type of survey in which the measurement of survey lines of the transverse of the transverse and their plotting to a suitable scale are done simultaneously on the field. It consists of:
- ✓ Drawing Board mounted on a tripod
- ✓ Aliade

Drawing board:
The drawing board is mad of well seasoned wood such as teak and its size varies from 400mm x 300mm to 750mm x 600 mm. the board is mounted on a tripod with ball and socket arrangement which allow the board to be leveled and rotated about the vertical axis.
Alidades:
1. The open slight alidade
2. The telescope alidade

The open slight alidade consists of a flat rectangular piece of wood of about, 25mm width, 12.5mm thickness and length varying from 200 to 500 mm. The leveled edge of the alidade is called finducial edge. Its edge is graduated and serves as a scale. Vertical sight vanes are mounted at both ends. One of the sight vanes is proved with a narrow slit and the other with a central vertical wire. The line of sight is in the same vertical plane as the finducial edge
The telescope aliadade consists of a telescope mounted on a horizontal axis the ends of which are supported on standards. A circular level or two spirit levels are attached to the base of the telescope to level the plane table.

Working operations

- ✓ Fixing
- ✓ Setting
- ✓ Levelling
- ✓ Orientation

Fixing

Fixing the table to the tripod stand

Setting

The table is set up at a convenient height say 1m above ground. The legs of the stand are spread apart and firmly fixed into the ground. The table is then centered. This means that the point plotted on the sheet corresponding to the station occupied should be exactly above the station on the ground. This is done by means of the plumbing fork.

Levelling

The table is then leveled either by ordinarily tilting the board or by ball and socket arrangement.

Orientation:

Orientation is the process of putting the plane table into some fixed direction so that line representing a certain direction on the drawing sheet is parallel to that direction on the ground.

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15. Discuss about contour mapping?

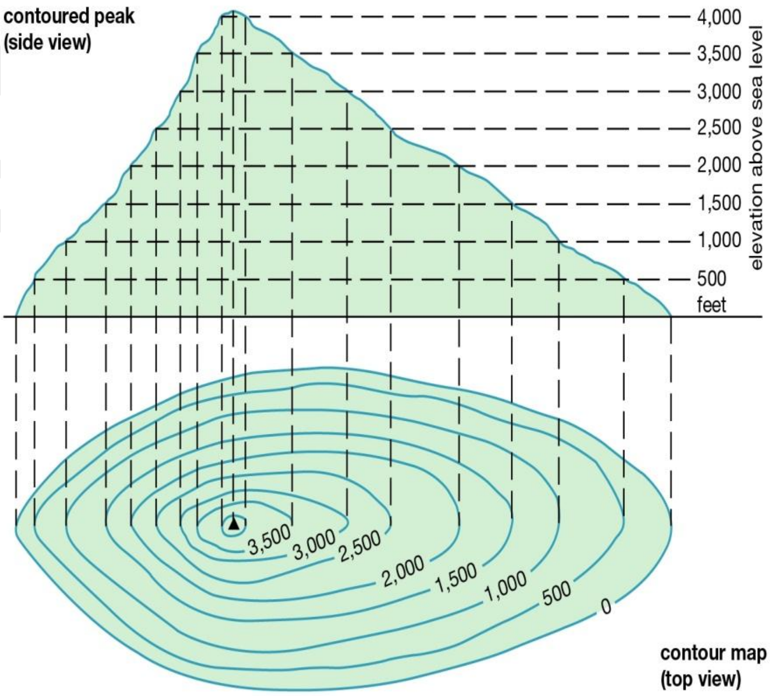
ANS:

An imaginary line on the ground surface joining the points of equal elevation is known as contour. In other words, contour is a line in which the ground surface is intersected by a level surface obtained by joining points of equal elevation. This line on the map represents a contour and is called contour line. A contour map is a type of map where the shape of the land surface is shown by the contour lines; the relative spacing done between these lines indicates the relative slope of the particular surface.

In the contour map meaning, it can be said that contour mapping is a type of topography mapping.

Contour maps represent changes in the elevation with the help of contour lines. Each of the contour lines being marked on a map joins the points having an equal height.

Contours are imaginary lines. These lines connect points of the same value. A contour map generally shows different contours such as the elevation or even the temperature contours. Contours are the lines on a map that join the same height. The Contour interval refers to the variation in height, example the contours are drawn at every meter. Contour lines on a map basically illustrate the height of a distinct place.



Uses of Contour Mapping: The Contours provide important information which can help us to study the nature of the terrain. This proves to be useful for the selection of sites, to determine the catchment area of a drainage basin, or to find intervisibility between two or more stations, etc.

Some of the uses of contours are described below.

1. Nature of Ground: To study the nature of the ground this catches interest.
2. To Locate Route: To identify the route, a contour map provides worthy information on how to locate a route.
3. Intervisibility between Stations: When the intervisibility between the two points cannot be easily ascertained by inspecting the area, then the contour map comes to the rescue.
4. To Determine Catchment Area or Drainage Area: The catchment area of a particular river can be well determined by using the contour map. The watershed line very well indicates the drainage basin of the river which passes through the ridges and then saddles of the terrain that turns around the river.

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16. Define the following: Elevation, Bench mark, Mean sea level?

ANSWER

Elevation: When the height of a point is its vertical distance above or below the surface of a reference plane we have selected, it is called the elevation of that point. For example When the height of a point is its vertical distance above or below mean sea level (as the reference plane), it is called the altitude of the point.

Bench mark: The term bench mark, or survey benchmark originates from the horizontal marks that surveyors made in stone structures, into which an angle iron could be placed to form a "bench" for a leveling rod, thus ensuring that a leveling rod could be accurately repositioned in the same place in the future. These marks were usually indicated with a chiseled arrow below the horizontal line. A benchmark is a type of survey marker.

Mean sea level: Mean sea level is a measurement of the average height of the sea between high and low tide. It is not dependent on any one place, in India or anywhere else. All elevations are measured above mean sea level which is a common base line in the whole world. Ex:- Height of mount Everest is 8850 mts.

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Unit-2 IMPORTANT QUESTIONS

Essay Questions (10M)

1. Discuss the objectives of surveying.
2. List out the types of chains used for linear measurements.
3. List out the types of tapes used for linear measurements.
4. Differentiate between forward bearing with backward bearing.
5. Define true bearing, magnetic bearing and arbitrary bearing.
6. Convert the following whole circle bearing to the quadrantal bearing:
   i) 600 ii) 1350 iii) 1900 iv) 2250 v) 3300.
7. Convert the following quadrantal bearing to whole circle bearing:
   i) N600E ii) S350E iii) S200W iv) N450W v) N750 W
8. Define various terms involved in leveling.
9. What are the different types of levelling staff? State the functions.
10. List out methods of levelling and explain any two.

Short answer questions (2M)

1. Define True, Magnetic and Arbitrary bearing.
2. What is meant by Forward bearing and backward bearing?
3. Define whole circle and quadrantal bearing.
4. What is contour?
5. Define reduced bearing.
6. Define the following: elevation, bench mark, Mean sea level
7. List out the methods of leveling