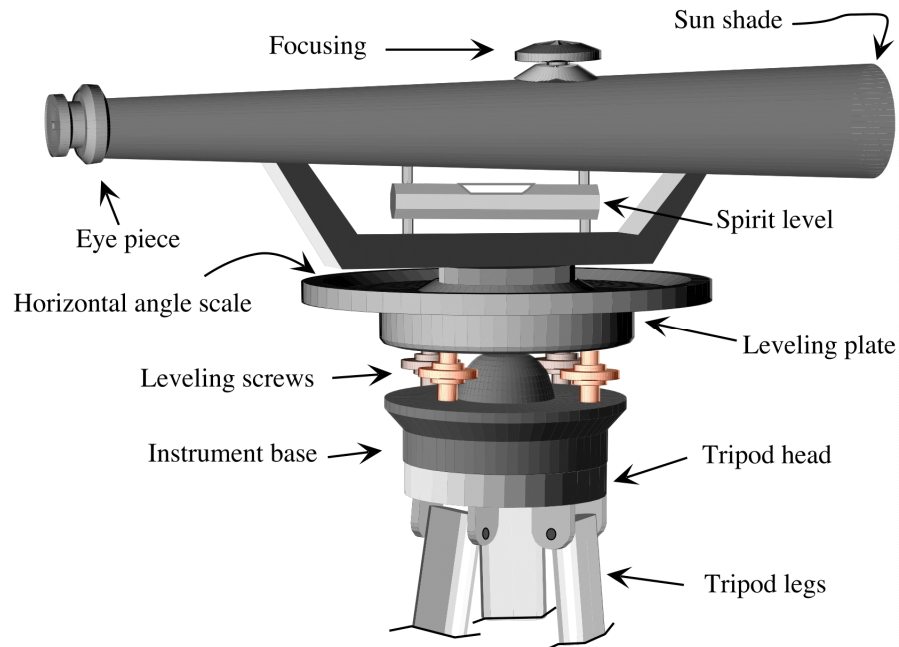


## UET-11-CE-SCET WAH

### SURVEYING-I

#### Dumpy (Wye) Level



- **LEVELLING:**
- It is a surveying method used to determine the level of points/objects with reference to the selected datum.
- It is also used to set out engineering works.

#### Uses of Levelling:

- To determine the difference in levels of points/Objects
- To obtain contour map of an area
- To obtain cross section of roads, canals etc.,
- To determine the depth cutting and filling in engineering works.
- To establish points or erect machinery or construct a building component at a predetermined level.

#### IMPORTANT TERMS

**Bench Mark:** It is surveyor's mark cut on a stone/ rock or any reference point used to indicate a level in a levelling survey.

**Reduced Level:**

- Reduced level of a point is the level of the point with respect to the level of permanent feature or bench mark.
- **It indicates whether the point is above or below the reference point (datum).**
- **INSTRUMENTS USED IN LEVELLING**

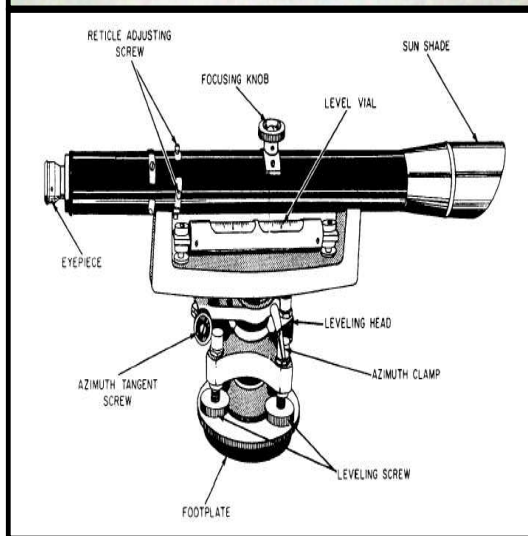
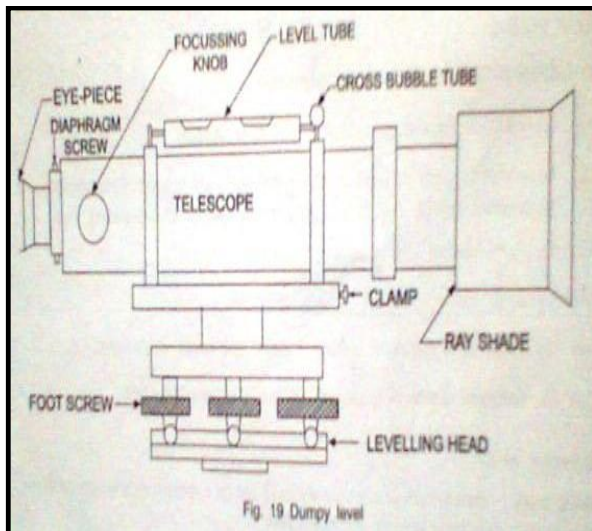
Instruments used in levelling are,

- (i) Levelling instrument
- (ii) Levelling staff

**Leveling Instrument :**

- Simplest form of levelling instrument is dumpy level.
- The different parts of levelling instrument are,
  - (a) **Telescope (b) Eye-piece (c) focusing knob (d) level tube (e) cross bubble (f) foot screws (g) levelling head (h) diaphragm**

**(b) DUMPY LEVEL**



- **LEVELLING STAFF:**
- It is an important accessory used with levelling instrument at the time of conducting levelling survey.
- Reading is taken on the levelling staff held properly at the point concerned by viewing through the telescope of the levelling instrument.
- Usually 4 m levelling staff may be used of folding type or telescopic type
- Aluminium levelling staff foldable at every metre length has also come to the market.
- The levelling staff consists of three pieces.

- The topmost one slides into the middle one and the middle portion slides into the bottom one.
- When the staff is fully pulled, it will read exactly 40 decimeters (4m) from the bottom shoe.
- GRADUATION IN LEVELLING STAFF:
- The graduation are made continuously one above the other in the same line.
- The division lines should be parallel to the base of the bottom shoe and perpendicular to the length of the staff.
- The edges of the division lines should be straight sharply defined.
- They should be clear and made distinctly visible by properly contrasting.

The **graduation color paints used should not crack or blister** when exposed to adverse or atmospheric conditions.

- IMPORTANT TERMS IN LEVELLING
- **Station** : In Levelling, the term station always refers to the point where the levelling staff is held and not the instrument station.
- **Height of Instrument** : It is the elevation of the line of sight with reference to the assumed datum.
- **Back Sight (B.S)** : It is the reading taken on the staff held at a point, the elevation of which is known already. It is useful to know the new height of the instrument.
- **Foresight (F.S)**: It is the reading taken on the staff held at a point of unknown elevation. From, F.S., the height of the line of instrument above the point can be obtained. It is useful to find the elevation of the point.
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- **Change Point** : It is the point at which the fore sight is taken from one instrument station and back sight is taken from the next instrument station.

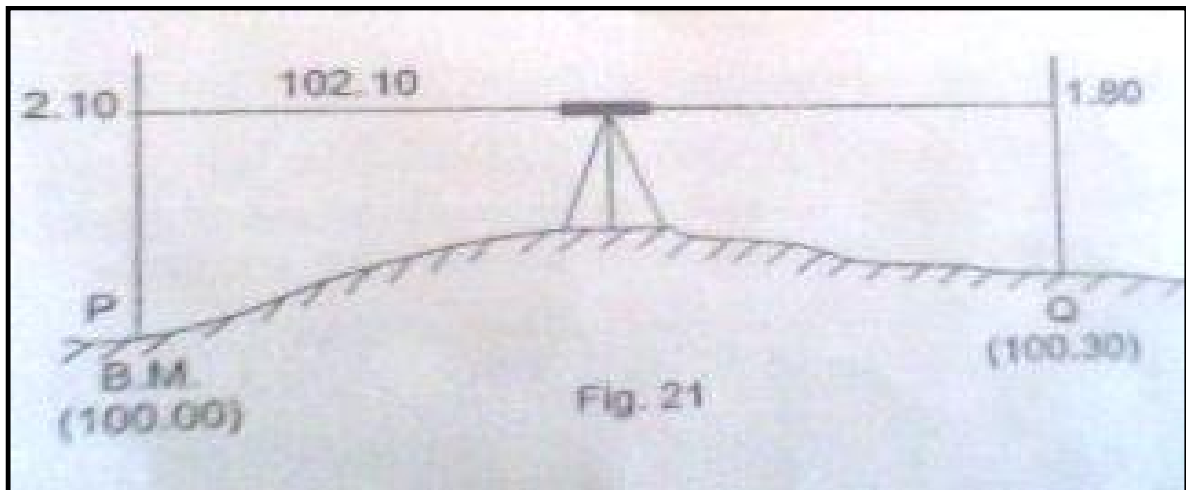
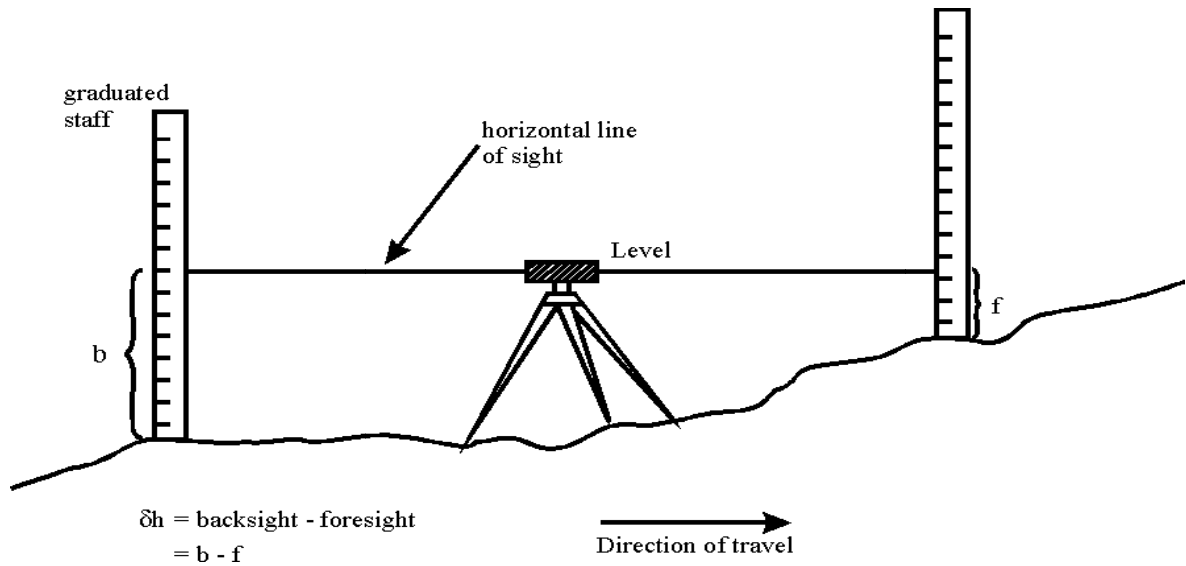
#### METHODS OF LEVELLING

- Method 1 : It is done with only one setting of the instrument.
- Method 2: When the two station points are wide apart and the instrument is set up at more than one point and the levelling is carried out.
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#### METHOD 1

##### WITH ONLY ONE SETTING OF THE INSTRUMENT

- The instrument is set up at a point between P and Q and the temporary adjustments carried out.
- The levelling staff is held at P, the elevation of which is known already.
- A back sight is taken on the staff held at P. The staff is then held at Q and the foresight is taken.
- 



Height of the instrument = Known elevation of P + the

staff reading at P

$$= 100.00 + 2.10 = 102.10 \text{ m}$$

Elevation of Q

= Height of the instrument -

**the staff reading at Q**

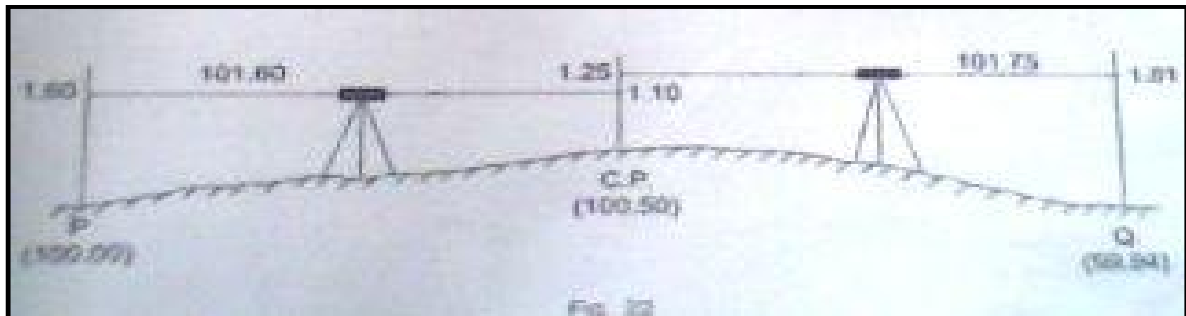
$$= 102.10 - 1.80 = \mathbf{100.30 \text{ m}}$$

#### METHOD II

WHEN THE STATION POINTS ARE WIDE APART, THE INSTRUMENT IS SETUP FOR AT MORE THAN ONE POINT AND LEVELLING IS DONE

(HEIGHT OF COLLIMATION METHOD:

- A change point (C.P) is established in between P and Q.
- A back sight is taken at P and a fore sight is taken at the change point.
- The instrument is shifted to another point between the change point and Q.
- A back sight is taken at the change point and a fore sight is taken at Q.
- Any number of change points are established as required.
- This method is known as Height of Collimation method.



**The elevation of change point = Elevation of P + Back sight at P – Fore sight at change point (C.P)**

$$= 100.00 + 1.60 - 1.10 = \mathbf{100.50 \text{ m}}$$

**The second height of the instrument = The elevation of change point +**

**Back Sight at change point**

$$= 100.50 + 1.25 = \mathbf{101.75 \text{ m}}$$

**The elevation of Q = The second height of instrument – foresight at Q**

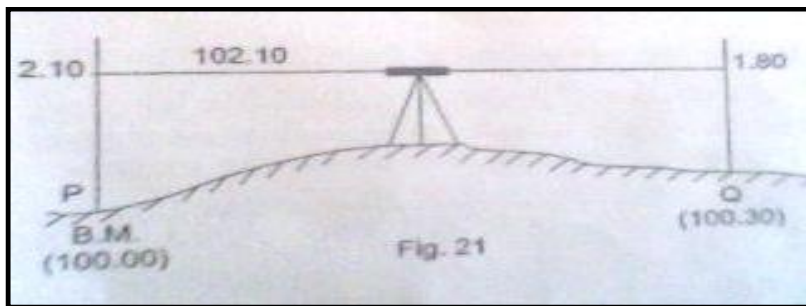
$$= 101.75 - 1.81 = \mathbf{99.94 \text{ m}}$$

RISE AND FALL METHOD OF CALCULATING THE LEVEL:

- The staff readings of the points observed from the same setting of the instrument are compared.

- It is found whether a point is above or below the preceding point.
- If the point is above, the staff reading will be less than the preceding point. The difference between the staff readings is called **rise**.
- If the point is below the preceding point, the staff reading will be greater than that at the preceding point. The difference between the staff readings is termed **fall**.

#### RISE AND FALL METHOD:



The difference between the staff readings

$$\text{at P and Q} = 2.10 - 1.80 = \mathbf{0.30 \text{ (rise)}}$$

Hence, level of Q = Elevation of P + Rise

$$= 100.00 + 0.30 = \mathbf{100.30 \text{ m}}$$

#### FLY LEVELLING:

- Any number of change points are established as required during levelling. This method is known as fly levelling.
- It is adopted to find the difference in level between two points, when
  - (i) The two points are too far away
  - (ii) the difference in level between two points is large
  - (iii) there are no obstructions in between the two points concerned.

#### CALCULATION OF AREAS

- One of the purposes of surveying is to determine the area to be surveyed.

- The area of the land obtained by surveying actually refers to the area as projected on a horizontal plane.
- There are different methods of computing the area of land using the data obtained by surveying.

#### CALCULATION OF AREA BY TRAPEZOIDAL RULE:

\*In trapezoidal, a convenient base line is established.\* Perpendicular distances from the base line to the boundary of the land concerned are measured at regular (equal) intervals along the base line.\* These perpendicular distances are called ordinates.