IAT- 1

11/07/2022.

ADVANCED SURVEYING - 18CV45

Scheme and Solution.

Q1) i) Transiting :- It is the process of turning the telescope about its horizontal axis through 180° in the vertical plane thus bringing it upside down & making it point, exactly in opposite direction (2M)

ii) Face left :- If the vertical circle of the instrument is on the left side of the observer while taking a reading, the position is called the face left. (2M)

iii) Face right :- If the vertical circle of the instrument is on the right side of the observer while taking a reading, the position is called the face right. (2M)

iv) Swing :- It means turning the telescope about its vertical axis in the horizontal plane (2M)

v) Trunion axis :- It is the axis about which the telescope can be rotated in the vertical plane (2M)

Q2) Measurement of horizontal angle by repetition method :-

→ This method is used for very accurate work. In this method, the same angle is added several times mechanically & the correct value of the angle is obtained by dividing the accumulated reading by the no. of repetitions

i) Set up the theodolite at starting point O & level it accurately

ii) Measure the horizontal angle AOB (3M)

iii) Loosen the lower clamp & turn the telescope clockwise until the object (A) is sighted again. Bised accurately by using the upper tangent screw. The verniers will now read the twice the value of the angle now

iv) Repeat the process unit the angle is repeated the required no. of times. Read both verniers. The final reading after n repetitions should be approximately n X (angle). Divide the sum by the no. of repetitions & the result thus obtained gives the correct value of the angle AOB

v) Change the face of the instrument repeat exactly in the same manner & find another value of the angle AOB. The average of two readings gives the required precise value of the angle AOB

3m
Table
4m

Q 3) i) Spire test :-

-> Instrument is established near to high rised object like transmission town or multistoried building with all temporary adjustments

-> Top of the object is bisected & horizontal plate is clamped. Telescope is noted down to get a point on the ground nares to the station at pt. (B)

-> Telescope is made to transit & the instrument swing back to bisect B again

-> Clamping the horizontal plate telescope is lifted up to bisect earlier point A if bisected instrument is said to be another pt. C is noted & in adjustment if not corrections has to be applied. 05 M

ii) Procedure to eliminate parallax in theodolite survey :-

1) Looking through the eyepiece is turned clockwise or anticlockwise till the cross hairs are seen dark.

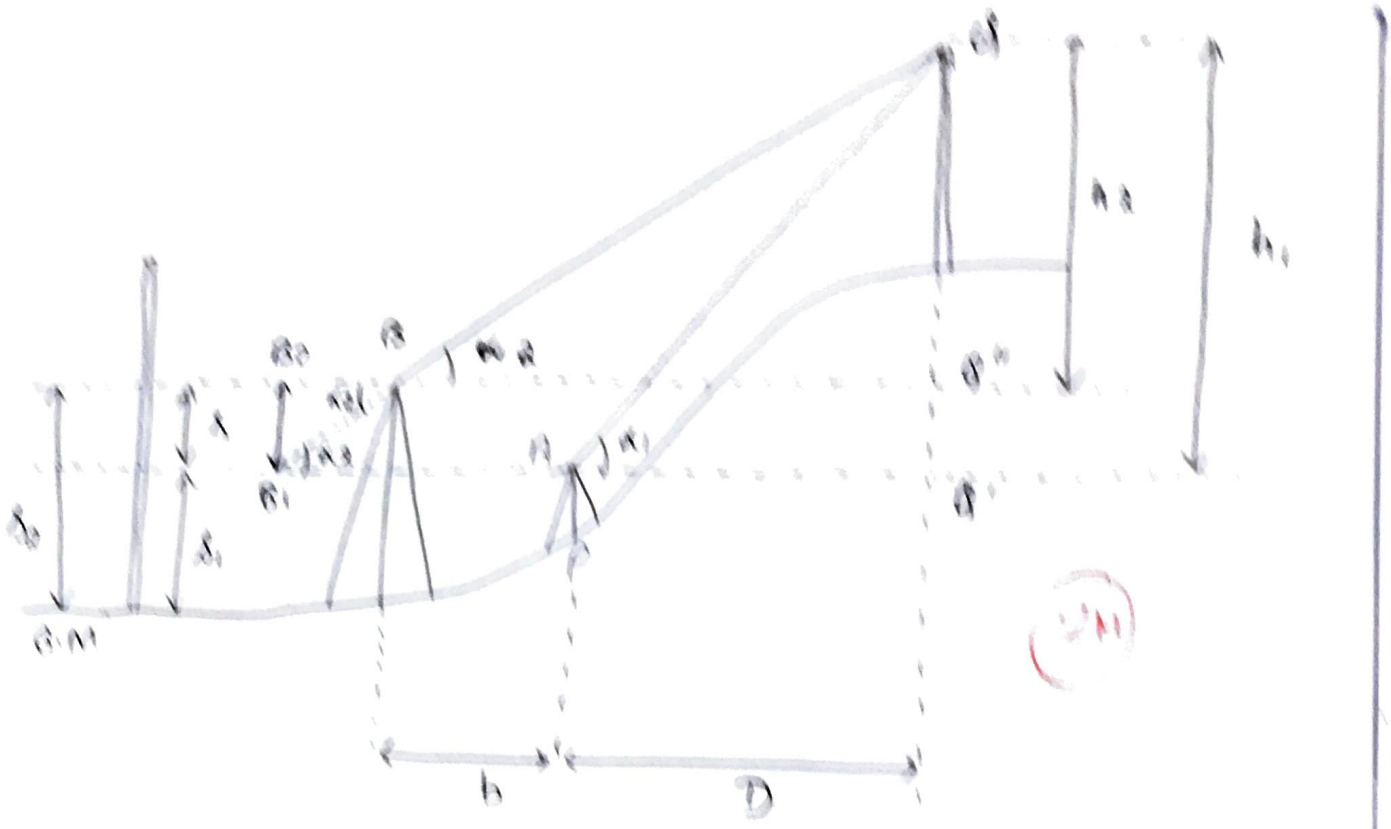
2) Telescope is turned to a far off object & looking through the eye piece the focussing screen is turned till the clear image of the object is seen

Q5) i) Baseline measurement :-

-> It is aligned & measured with great accuracy
-> It forms the basis for computation of the triangulation system
-> Length of the base line depends upon the grades of triangulation (5M)

ii) Well conditioned triangle

Triangle whose any of the three interior angles are such that $30° < \theta < 120°$.
Any error in angular measurements must have a very minimum effect on the computed lengths. To ensure that two sides of a triangle are equally affected, the triangle must be at least isoceles & preferably equilateral triangle (5M)



(½M)

Let S_1 & S_2 are the staff readings on BM corresponding to the position of instrument at P & R respectively.

We have $S = S_1 - S_2$ if A is higher

$S = S_2 - S_1$ if B is higher

In $\triangle APQ'$, $h_1 = D \tan\alpha_1$ ——— (1)

In $\triangle BQQ''$, $h_2 = (b+D)\tan\alpha_2$ —— (2)

From (1) & (2), $b\tan\alpha_2 + D\tan\alpha_2 - D\tan\alpha_1 = (h_2 - h_1)$

but $h_2 - h_1 = S = S_1 - S_2$

$\therefore D(\tan\alpha_2 - \tan\alpha_1) = S - b\tan\alpha_2$

$\therefore D = \dfrac{S - b\tan\alpha_2}{\tan\alpha_2 - \tan\alpha_1}$ or $\dfrac{S + b\tan\alpha_2}{\tan\alpha_1 - \tan\alpha_2}$

R.L of Q = R.L of BM + S_1 + h_1 (½M)

(½M) procedure steps (½M)

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Q6)

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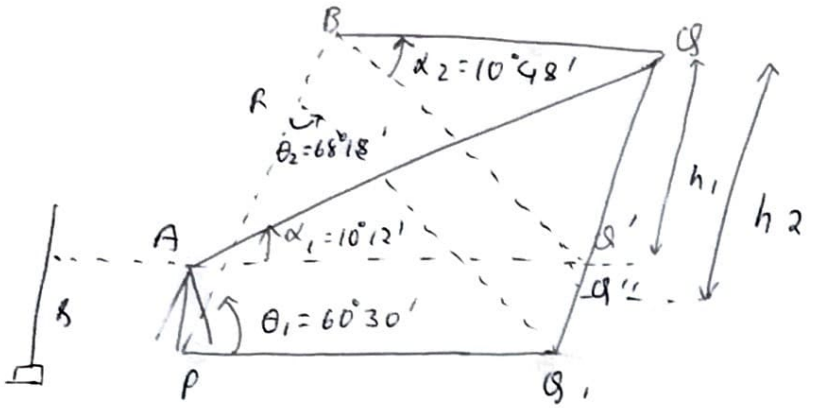


BM = 435.065m

From Δ^{le} PQR, by sin rule $\frac{RQ_1}{\sin\theta_1} = \frac{PQ_1}{\sin\theta_2} = \frac{PR}{\sin(\theta_1+\theta_2)}$

$\therefore RQ_1 = \frac{b\sin\theta_1}{\sin(\theta_1+\theta_2)} = \frac{60 \times \sin 60°30'}{\sin(60°30' + 68°18')} = 67.001\ m$ (2M)

$D = PQ = \frac{b\sin\theta_2}{\sin(\theta_1+\theta_2)} = \frac{60 \times \sin 68°18'}{\sin(60°30' + 68°18')} = 71.532\ m$ (2M)

RL of Q = RL of BM + $s_1 + h_1$

= 435.065 + 1.965 + 71.532 tan 10°12'

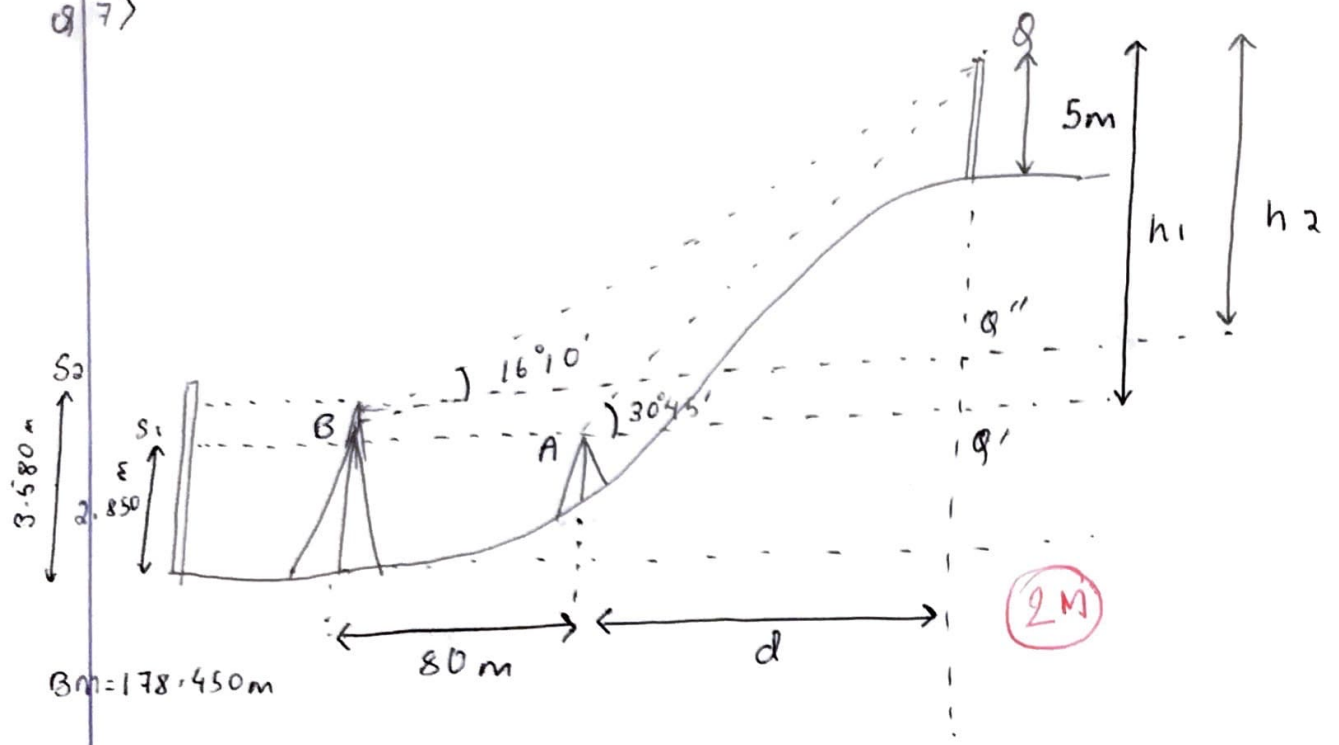
= 449.900 m (3M)

Check : RL of Q = RL of BM at R + $s_2 + h_2$

= 435.065 + 2.055 + 67.001 × tan 10°48'

= 449.901 m — (3M)

Q 7)



In $\triangle le$ QAQ'

$h_1 = d \tan 30°45'$

In $\triangle le$ QBQ''

$h_2 = (80+d) \tan 16°10'$ 2M

$S_2 - S_1 = h_1 - h_2$

$\Rightarrow 3.58 - 2.85 = d \tan 30°45' - (80+d) \tan 16°10'$

$\Rightarrow 0.73 = d \tan 30°45' - 80 \tan 16°10' - d \tan 16°10'$

$\Rightarrow 23.92 = d\ 0.305$

$\Rightarrow d = 78.426\text{m}$ 2M

$\Rightarrow h_1 = 78.426 \tan 30°45' = 46.659\text{m}$

$h_2 = (80+78.426) \tan 16°10' = 45.927\text{m}$ 2M

RL of ~~top~~ bottom of signal = BM + S_1 + h_1 − 5

= 178.45 + 2.85 + 46.659 − 5

= 222.959 m //

RL of top of signal = BM + S_1 + h_1

= 227.959 m // 2M

End of scheme