Model Question Paper-1 with effect from 2019-20 (CBCS Scheme)

USN ☐☐☐☐☐☐☐☐☐☐

Fourth Semester B.E. Degree Examination

Advanced Surveying

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE.**

<table>
<tr><th colspan="3">Module -1</th><th>*Bloom's Taxonomy Level</th><th>Marks</th></tr>
<tr><td>Q.01</td><td>a</td><td>With the help of tabular column, explain the procedure of measuring horizontal angle by (i) Repetition method (ii) Reiteration method</td><td>L2</td><td>8</td></tr>
<tr><td></td><td>b</td><td>List the fundamental lines of a theodolite. Summarize the desired relationship between them.</td><td>L2</td><td>6</td></tr>
<tr><td></td><td>c</td><td>Define the following terms.
i) Transiting
ii) Swinging
iii) Trunnion axis</td><td>L2</td><td>6</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>Q.02</td><td>a</td><td>To find the elevation of the top(P) of a hill, a flag staff of height 1.5m was erected and the following observations were made from two stations A & B at considerably different elevations 156m apart. The angle of elevation from A to the top of the flag staff was 38^{0}24' and that from B to the same point 26^{0}12'. A vane 1.2m above the foot of a staff held on A was sighted from B and the angle of elevation was observed to be 9^{0}54'. The height of the instrument axis at A was 1.494m and the R.L. of the instrument axis at B was 45.00m. Find the horizontal distance P from B and the R.L. of P.</td><td>L3</td><td>10</td></tr>
<tr><td></td><td>b</td><td>Derive the expressions for the horizontal distance, vertical distance and the elevation of an object by double plane method, when the base is inaccessible.</td><td>L3</td><td>10</td></tr>
<tr><td colspan="5">**Module-2**</td></tr>
<tr><td>Q. 03</td><td>a</td><td>Derive distance and elevation formulae for stadia tachometry, when staff held normal to the line of sight, for both an angle of elevation and angle of depression.</td><td>L3</td><td>10</td></tr>
<tr><td></td><td>b</td><td>To find the gradient between two points A and B a tacheometer was set up to another station C and the following observations were made, keeping the staff vertical.
<table>
<tr><th>Staff at</th><th>Vertical angle</th><th>Staff readings (m)</th></tr>
<tr><td>A</td><td>+ 4^{0}20'00"</td><td>1.300, 1.610, 1.920</td></tr>
<tr><td>B</td><td>+ 0^{0}10'40"</td><td>1.100, 1.410, 1.720</td></tr>
</table>
If the horizontal angle ACB is 35^{0}20', determine the average gradient between A and B. K = 100, C = 0</td><td>L3</td><td>10</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>Q.04</td><td>a</td><td>List the various factors that are to be considered in the selection of site for baseline and station in triangulation survey.</td><td>L2</td><td>6</td></tr>
<tr><td></td><td>b</td><td>Write a note on classification of triangulation system.</td><td>L2</td><td>6</td></tr>
<tr><td></td><td>c</td><td>From a satellite station S, 5.8m from main triangulation station A, the following directions were observed.
<table>
<tr><td>A</td><td>0^0</td><td>0'</td><td>0"</td></tr>
<tr><td>B</td><td>132^0</td><td>18'</td><td>30"</td></tr>
<tr><td>C</td><td>232^0</td><td>24'</td><td>6"</td></tr>
<tr><td>D</td><td>296^0</td><td>6'</td><td>11"</td></tr>
</table>
The lengths of AB AC and AD were computed to be 3265.5m, 4022.2m and 3086.4m respectively. Determine the directions of AB, AC and AD.</td><td>L3</td><td>8</td></tr>
</table>

		Module-3		
Q. 05	a	List the different methods of setting out simple circular curves. Explain the linear method of setting out simple curve by the method of offset from long chord.	L3	6
	b	A road bend which deflects 80^0 is to be designed for a maximum speed of 100km per hour, a maximum centrifugal ratio ¼ and a maximum rate to the change of acceleration of 30cm/sec^3, the curve consisting of a circular arc combined with two spirals. Calculate i) The radius of circular arc ii) The required length of transition iii) the total length of composite curve and iv) The chainages of the beginning and end of transition curve, and of the junctions of the transition curves with the circular arc, if the chainage of the point of intersection is 42862m.	L3	10
	c	With the help of a neat sketch of a simple circular curve, explain i) Tangent length ii) Length of long chord iii) Point of curve iv) Forward tangent	L2	4
		OR		
Q. 06	a	A compound curve consisting of two arcs of radius 350m and 550m connects two straights AB and BC, which are intersected by a line PQ. The angles APQ and BQP are 139^{0}30' and 36^{0}24' respectively. Determine the chainages of the tangent points if the chainage of the intersection point B is 5425.191m.	L3	8
	b	The first branch of a reverse curve has a radius of 200m. Find the radius of second branch so that the curve can connect parallel straights 18m apart. The distance between tangent points is to be 110m. Also calculate the length of two branches of the curve.	L3	8
	c	With a neat sketch, list any four vertical curves.	L2	4
		Module-4		
Q. 07	a	Define vertical photograph, tilted photograph and oblique photograph.	L2	6
	b	A vertical photograph was taken at an altitude of 1200m above the mean sea level. Determine the scale of photograph for terrain lying at elevation of 80m and 300m, if the focal length of camera is 15cm.	L3	8
	c	List the reasons for keeping overlap in photographs.	L2	6
		OR		
Q. 08	a	Derive the expression for relief displacement on a vertical photograph.	L3	8
	b	Explain the procedure for aerial survey.	L2	6
	c	Find the number of photographs (size 250 x 250mm) required to cover over a area of 20km x 16km, the longitudinal overlap is 60% and the side overlap is 30% scale of the photograph is 1cm = 150m.	L3	6
		Module-5		
Q. 09	a	Define remote sensing. Explain the stages of idealized remote sensing system.	L2	8
	b	With neat sketch, explain the electromagnetic spectrum.	L2	6
	c	Explain the components of GIS.	L2	6
		OR		
Q. 10	a	Mention the advantages of total station and also discuss the working principles of the same.	L2	8
	b	What are the advantages of LIDAR technology?	L2	4
	c	What is GPS? Explain the basic principles of GPS and its application in surveying.	L2	8

ADVANCE SURVEYING (18CV45) QP SOLUTION

Q1.a. **REPETITION METHOD**

1) Theodolite is set over an instrument station (0) exactly & all the temporary adjustments are done.
2) With both the clamps released, the lower plate is brought to nearly 0°, the upper clamp is then tightened. And the reading is made precisely 0°0'0" by using upper tangent screw.
3) Lower clamp is loosened and the telescope is swung untill the left hand station 'P' is approximately sighted. Lower clamp is then & pnt 'P' is bisected exactly using lower tangent screws.
4) Both the verniers A and B are read & noted. (= 0° & 180° resp.)
5) Upper clamp is unclamped & telescope is swung clockwise & 'Q' is bisected. Upper clamp is clamped & 'Q' is bisected exactly using upper tangent screw. Lower plate reading will give horizontal angle.
6) Release the lower clamp & once again bisect th left handed station 'P' exactly.
7) Unclamp the upper clamp. Swing the telescope in clockwise direction, untill the second station Q is sighted accurately. This completes 2 repetitions & lower plate reading now gives double horizontal angle.
8) The procedure (steps 7 & 8) are repeated 3-6 times, depending upon the accuracy required.
9) Finally obtained reading is divided by no of repetitions to get the mean value of angle POQ.
10) Change the face of the instrument & repeat above procedure
11) The average of 2 face observations gives required horizontal angle.

Inst Stn	Staff Stn	Face Left					Swing: Right				Face: Right					Swing: Right				Avg Hor Angle		
		A			B		Mean			N	A			B		mean			N			
		°	′	″	′	″	°	′	″		°	′	″	′	″	°	′	″		°	′	″
O	P	0	0	0	0	0	0	0	0													
	Q																					

Q1.b. The fundamental lines are as follows

i) Vertical axis ii) Horizontal axis.

iii) Line of sight iv) Axis of plate level.

v) Axis of altitude level.

① Desired relation b/w the fundamental axes.

i) The axis of plate level must be ⊥r to the vertical axis.

ii) The line of collimation must be ⊥r to the horizontal axis.

iii) The horizontal axis must be ⊥r to the vertical axis.

iv) The axis of the altitude level must be ||el to the line of collimation.

v) The vernier reading of vertical circle must read zero when the line of collimation is horizontal.

Q1.c. TRASITING:

Transiting is also known as plunging or reversing. It is 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.

SWINGING:

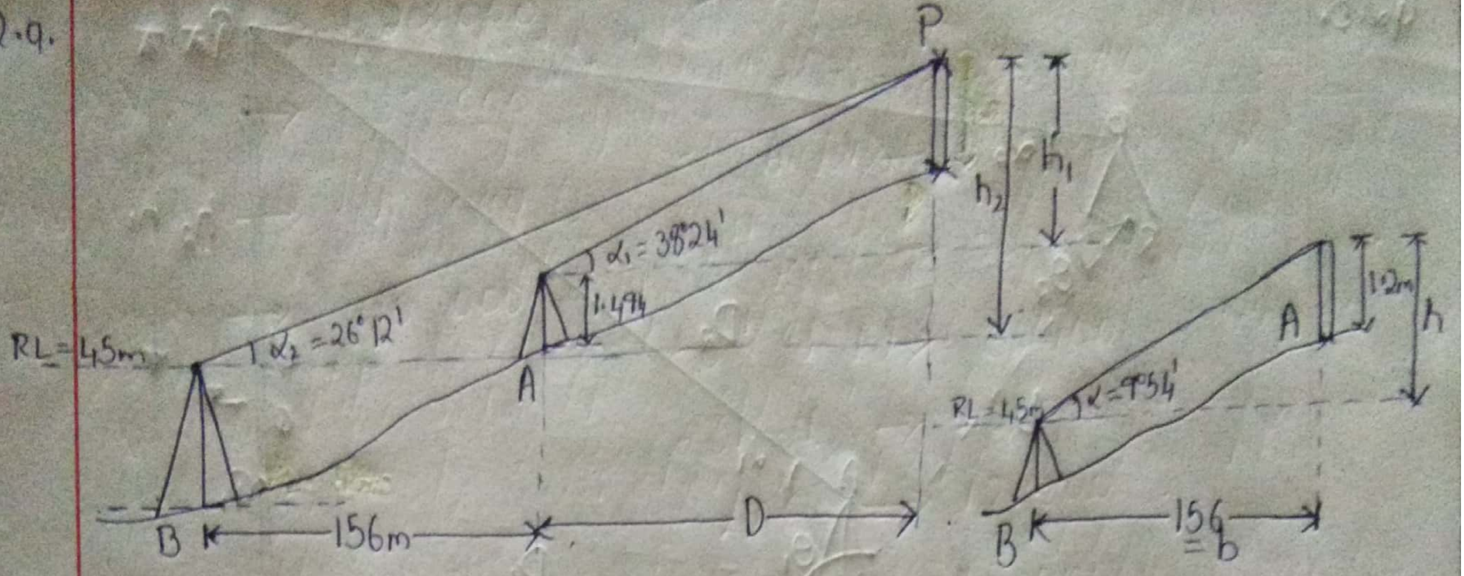
It is process of turning the telescope about its vertical axis in the horizontal plane. If the telescope is rotated in clockwise direction, it is known as right swing. If the telescope is rotated in anti clockwise direction it is known as left swing.

TRUNION AXIS.

It is the axis about which the telescope can be rotated in the vertical plane.

It is also called as horizontal axis.

Q2.a.



OBSERVATIONS TAKEN FROM B to A.

$h = b\tan\alpha = 156\tan 9°54' = 27.22m$

RL of A = RL of B + h − 1.2 = 45 + 27.22 − 1.2 = 71.03m.

∴ RL of Instrument axis at A = RL of A + HI = 71.03 + 1.494 = 72.52m.

Difference in elevation of instrument axis = 72.52 − 45 = 27.52m = S.

$$D = \frac{b\tan\alpha_2 - S}{\tan\alpha_1 - \tan\alpha_2}$$

$$= \frac{156\tan 26°12 - 27.52}{\tan 38°24' - \tan 26°12'}$$

$$= \frac{49.25}{0.3}$$

∴ D = 164.138m

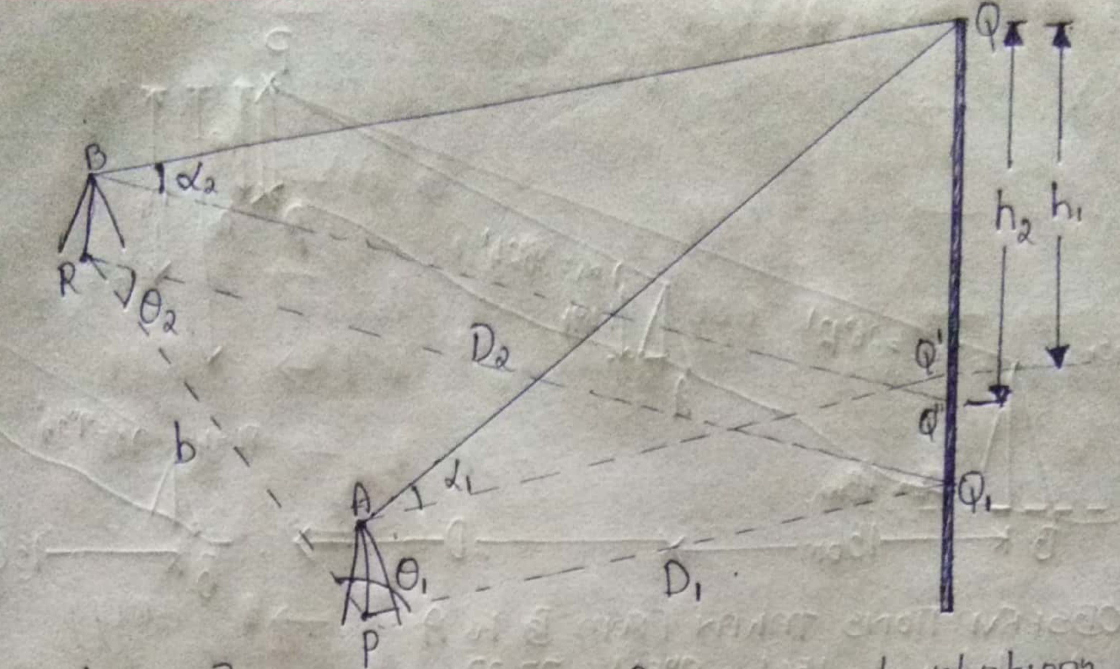
$h_1 = D\tan\alpha_1 = 164.138\tan 38°24' = 130.1$ m

$h_2 = (156 + D)\tan\alpha_2 = 157.53$ m

RL of P = RL of Instrument axis at A + h_1 = 72.52 + 130.1 = 202.62m

CHECK RL of P = RL of Instrument axis at B + h_2 = 45 + 157.53 = 202.6m

Q2.b.



Let P and R be the 2 instrument stations not in the same vertical plane. Q be the top of the object.

Let, $\alpha_1 \longrightarrow$ AOE from P to Q, $\alpha_2 \longrightarrow$ AOE from R to Q

$\theta_1 \longrightarrow$ Hor ∠le at P b/w R and Q, $\theta_2 \longrightarrow$ Hor ∠le at R b/w P and Q

$b \longrightarrow$ Horizontal dist b/w P and R, $D_1 \longrightarrow$ Hor dist b/w P and Q.

From Δ^{le} AQQ', $h_1 = D_1 \tan\alpha_1$

From Δ^{le} BQQ'' $h_2 = D_2 \tan\alpha_2$.

From Δ^{le} PQ_1R $\angle PQ_1R = 180-(\theta_1+\theta_2)$.

Applying sine rule we get

$$\frac{D_1}{\sin\theta_2} = \frac{D_2}{\sin\theta_1} = \frac{b}{\sin[180-(\theta_1+\theta_2)]} \Rightarrow \frac{D_1}{\sin\theta_2} = \frac{D_2}{\sin\theta_1} = \frac{b}{\sin(\theta_1+\theta_2)}$$

$$D_1 = \frac{b\sin\theta_2}{\sin(\theta_1+\theta_2)} \qquad D_2 = \frac{b\sin\theta_1}{\sin(\theta_1+\theta_2)}$$

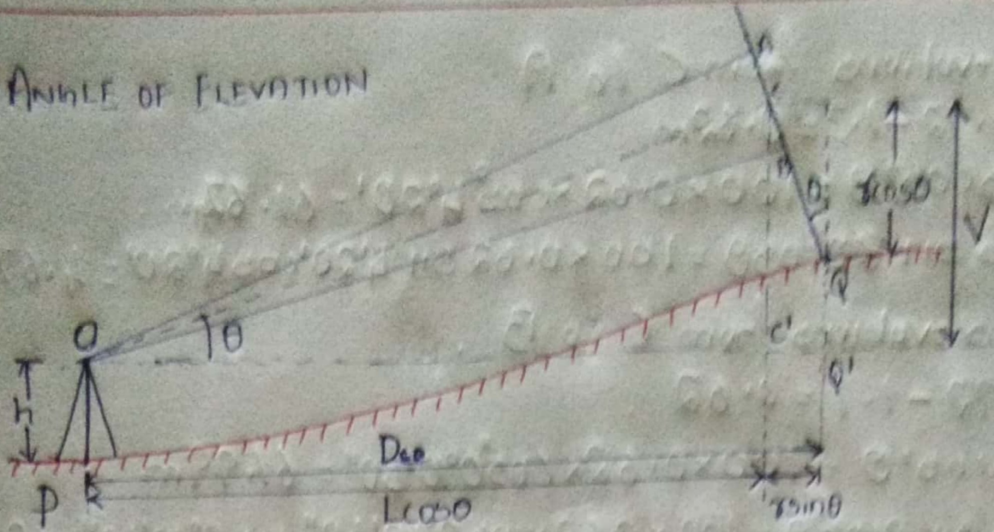
$$\therefore h_1 = \frac{b\sin\theta_2\tan\alpha_1}{\sin(\theta_1+\theta_2)} \quad \text{and} \quad h_2 = \frac{b\sin\theta_1\tan\alpha_2}{\sin(\theta_1+\theta_2)}$$

RL of Q = RL of BM + S_1 + h_1 ($S_1 \longrightarrow$ SR taken from P on BM)

RL of Q = RL of BM + S_2 + h_2 ($S_2 \longrightarrow$ SR taken from Q on BM)

Q3.a.

i) ANGLE OF ELEVATION



Let P → instrument station, Q → staff station.

O → Optical centre of instrument   A, B and C → Pnt corresponding to 3 hairs

s → AB → staff intercept   i → stadia interval

θ → Inclination of LOS from horizontal.   L → length OC along LOS

D → OQ → Horizontal dist b/w instrument & staff.

V → Vertical intercept b/w LOS & horizontal line

h → Height of Instrument   r → central hair reading

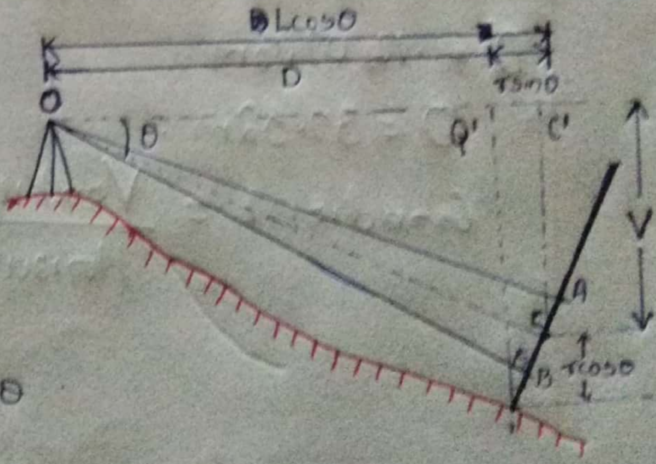
We have, $OC = L = ks + C$

$D = OC' + C'Q' = L\cos\theta + r\sin\theta = (ks+C)\cos\theta + r\sin\theta$

Similarly $V = L\sin\theta = (ks+C)\sin\theta$

$\therefore$ Elevation of Q = RL of P + h + V − r cos θ

ii) ANGLE OF DEPRESSION



$OC' = L = ks + C$

$D = OQ' = OC' - Q'C'$

$D = L\cos\theta - r\sin\theta$

$V = L\sin\theta = (ks+C)\sin\theta$

RL of Q = RL of P + h − V − r cos θ

Q3.b.

a) Observations from C to A

$s = 1.92 - 1.3 = 0.62m$

$D_A = ks\cos^2\theta = 100 \times 0.62 \times \cos^2 4°20' = 61.64m$

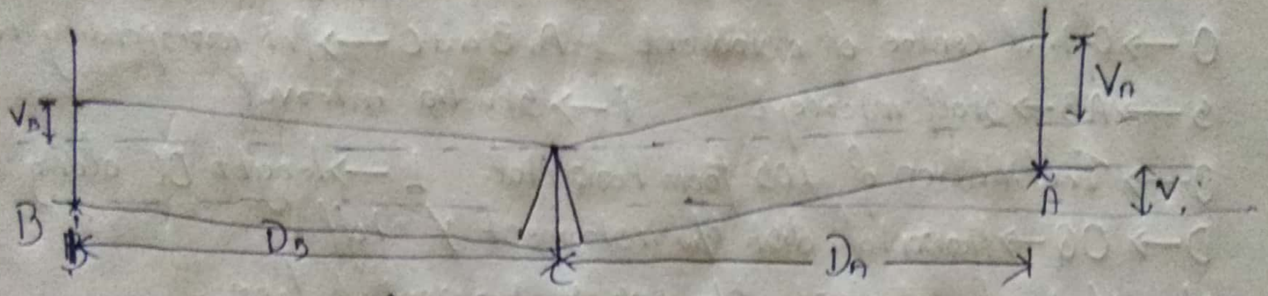
$V_A = ks\sin\theta\cos\theta = 100 \times 0.62 \sin 4°20' \cos 4°20' = 4.67m$.

b) Observations from C to B.

$s = 1.72 - 1.1 = 0.62$

$D_B = ks\cos^2\theta = 100 \times 0.62 \times \cos^2 0°10'40'' = 61.99m$.

$V_B = ks\sin\theta\cos\theta = 100 \times 0.62 \times \cos 0°10'40'' \times \sin 0°10'40'' = 0.192m$.



$V = V_A - V_B \longrightarrow$ Diff'c in elevation b/w A and B.

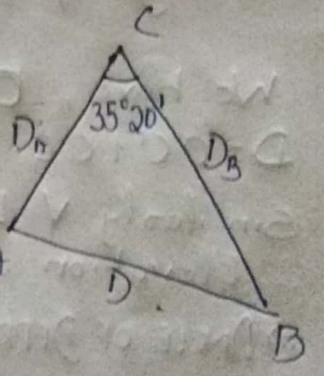
$V = 4.67 - 0.192 = 4.478m$

From Δ^{le} ABC

Apply cosine Rule.

$D^2 = D_A^2 + D_B^2 - 2 \times D_A \times D_B \cos 35°20'$

$= 61.64^2 + 61.99^2 - 2 \times 61.64 \times 61.99^2 \cos 35°20'$



$D^2 = 1407.8m$

$D = 37.52m$.

$$\text{Gradient} = \frac{\text{Vertical Dist}}{\text{Horizontal Dist}} = \frac{V}{D} = \frac{4.478}{37.52} = \frac{1}{8.38}$$

Q4a. The factors to be considered while selecting

Ⓐ BASELINE are

1) Th site should be fairly level. If, however ground is sloping the slope should be uniform & gentle.

2) The site should be free from obstructions throughout the whole of the length.

3) The extremities of the base should be intervisible at ground level.

Ⓑ STATION are.

1) The stations should form a well shaped Δ^{le}. In general no angle should be < 30° or > 120°.

2) The station should be easily accessible & also s.t food, water & camping ground is avaible nearby.

3) The stations should be intervisible. That's why they must be placed upon elevated ground.

Q4b. The basis of the classification of triangulation is the accuracy with which length & azimuth of a line is measured.

1) FIRST ORDER or PRIMARY TRIANGULATION.

is the highest order & is employed either to determine earth's figure or to furnish the most precise control points.

The primary triangulation s/m embraces the vast area.

2) SECOND ORDER or SECONDARY TRIANGULATION.

This s/m of triangulation consists of a no. of points fixed within the framework of primary triangulation

The stations are fixed at close intervals so that the sizes of the Δ^{le} formed are smaller than primary triangulation.

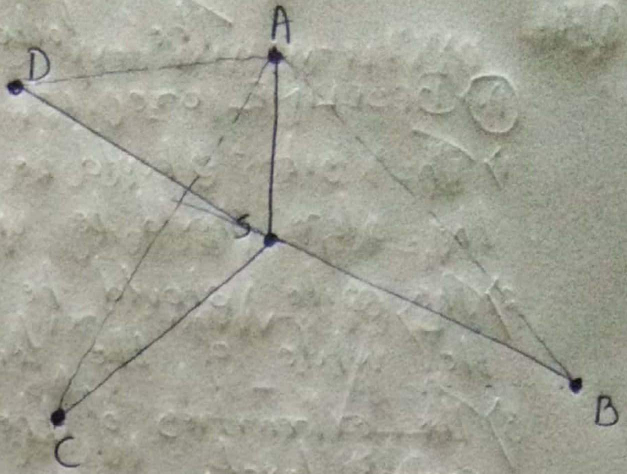
3) THIRD ORDER or TERTIARY TRIANGULATION

consists of a no. of points fixed within the framework of secondary triangulation.

The form the immediate control for detailed engineering surveys

The sizes of the Δ^{les} are small & instrument with moderate precision may be used.

Q4.C



LINE AB

$\theta = 132° 18' 30''$ (Given).

$d = AS = 5.8m$

Correction to θ, $\beta = \frac{d \sin\theta}{D \sin 1''}$

$\beta = \frac{5.8 \sin 132° 18' 30''}{3265.5} \times 206265 \text{ sec}$

$= 270.9'' = 4' 30.9''$

Direction of AB = Direction of SB + β

$= 132° 18' 30'' + 0° 4' 30.9''$

$= 132° 23' 0.9''$

LINE AC

$\theta = 232° 24' 6''$ $\quad D = AC = 4022.2m$

$\beta = \frac{5.8 \sin 232° 24' 6''}{4022.2} \times 206265 \text{ sec}$

$= -235.7'' = -0° 3' 55.7''$

Direction of AC $= 232° 24' 6'' - 0° 3' 55.7''$

$= 232° 20' 4.3''$

LINE AD

$\theta = 296° 6' 11''$ $\quad D = AD = 3086.4m$

$\beta = \frac{5.8 \sin 296° 6' 11''}{3086.4} \times 206265$

$= -348.1$ seconds $= -5' 48.1''$

Direction of AD $= 296° 6' 11'' - 0° 5' 48.1''$

$= 296° 0' 22.9''$

Q5a. The different methods of setting out simple circular curves are

LINEAR METHODS

1) Offsets from long chord
2) Successive bisection of arcs
3) Offsets from the tangents
4) Offsets from chord produced.

ANGULAR METHODS

1) Rankine's method of tangential ∠le
2) Two theodolite method.
3) Tacheometric method.

OFFSET from long chord.

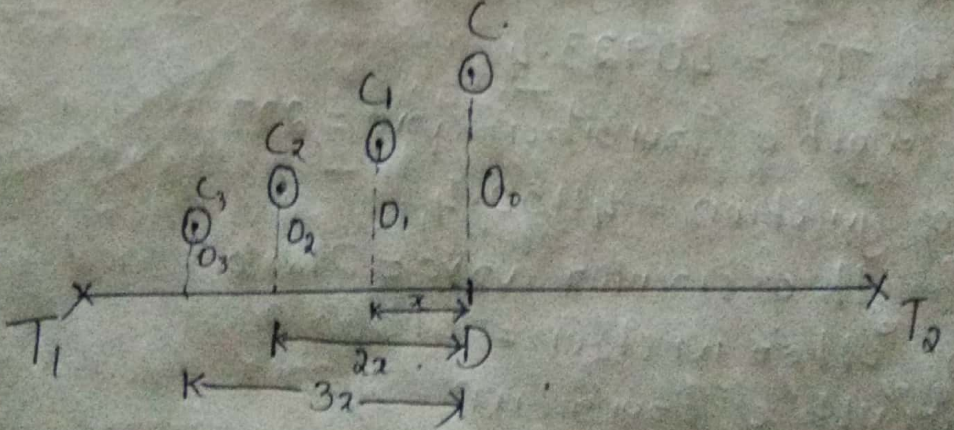
1) Lay down the chain along the long chord from T_1 to T_2 marking the mid point 'D'.

2) From D take a ⊥ offset of length O_0 & mark the point 'C'

3) At a distance x from the mid point 'D' take another perpendicular offset $O_1 \left(= \sqrt{R^2+x^2} - R \right)$ and mark the point C_1

4) Similarly mark points at intervals x take perpendicular offsets O_2, O_3 ..... etc & mark points C_2, C_3 ..... etc till you reach point T_1 and T_2 on either side.

5) Join points C, C_1, C_2 ... C_3 to get curve.



Q5.b.

$V = 100$ kmph

$V = \frac{100 \times 1000}{60 \times 60} = 27.78$ m/sec

centrifugal ratio $= V^2/gR = 1/4$

$R = 4V^2/g = 4(27.78)^2/9.81 = 314.68 \simeq 315$m

The length of transition curve is given by

$$L = \frac{V^3}{\alpha R} = \frac{(27.78)^3}{0.3 \times 315} = 226.9\text{m} \simeq 227\text{m}.$$

$\Delta_s = \frac{L}{2R}$ radians $= 1719 \frac{L}{\min} = 1719 \frac{227}{315} = 20° 38' 48''$

Central angle for the circular curve, $\Delta_c = \Delta - 2\Delta_s$.

$\Delta_c = 80° - 2 \times 20° 38' 48'' = 38° 42' 24''$.

Length of circular curve $= \frac{\pi R \Delta_c}{180°} = \frac{\pi \times 315 \times 38° 42' 24''}{180°}$

$= 212.8$m.

Total length of the composite curve $= 212.8 + 2 \times 227$

$= 666.8$m

Shift, $S = L^2/24R = 227^2/(24 \times 315) = 6.82$m.

Total tangent length $= (R+S)\tan\Delta + \frac{L}{2} = (315 + 6.82)\tan 80° + \frac{227}{2}$

$= 1938.6$m.

Chn. of PI = 42862

Deduct tangent length = 1938.6

Chn. of T_1 = 40923.4

Add length of Transition curve = 227

Chn. of junction = 41150.4.

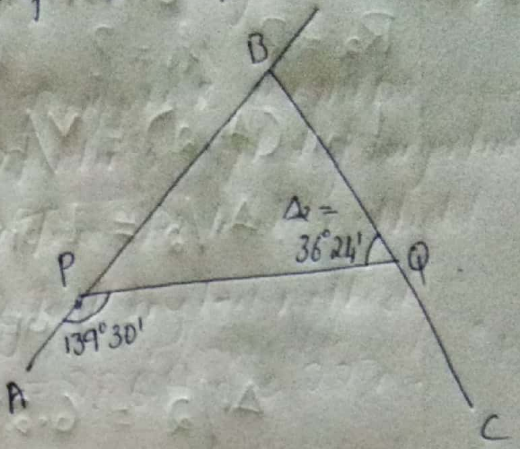
Add length of circular curve = 212.8

Chn of other junction = 41363.2.

Add length of transition = 227

Chn. of T_2 = 41590.2.

Q6.a. Given, $R_s = 350m$ $R_L = 550m$ Chn. of PI = 5425.191m.



$\Delta_1 = \angle BPQ = 180° - 139°30' = 40°30'$

$\Delta = \Delta_1 + \Delta_2 = 40°30' + 36°24' = 76°54'$

$t_s = R_s \tan(\Delta_1/2) = 350 \tan(40°30'/2)$

$t_s = 129.12m$

$t_L = R_L \tan(\Delta_2/2) = 550 \tan(36°24'/2)$

$= 500 \tan 18°12' = 164.4m.$

$$T_s = (t_s + t_L)\frac{\sin\Delta_2}{\sin\Delta} + t_s$$

$$= (129.12 + 164.4)\frac{\sin 36°24'}{\sin 76°54'} + 129.12 = 307.95m$$

length of 1st curve, $l_1 = \frac{\pi R_s \Delta_1}{180°} = 247.4m.$

length of 2nd curve $l_2 = \frac{\pi R_L \Delta_2}{180°} = 317.65m$

Chn. of PC (T_1) = Chn. of PI − T_s = 5425.19 − 307.95
= 5117.24m.

Chn. of PCC = Chn. PC + l_1 = 5117.24 + 247.4
= 5364.64m.

Chn. of PT = Chn. PCC + l_2 = 5364.64 + 317.65
= 5682.3m.

Q6b. Given $V = 12m$ $h = 110m$ $R_1 = 200m$

$R_2 = ?$ $l_1 = ?$ $l_2 = ?$

$\tan(\Delta_1/2) = V/h$

$\therefore \Delta_1/2 = \tan^{-1}[V/h]$

$= \tan^{-1}[12/110]$

$\Delta_1/2 = 6.226$

$\therefore \Delta_1 = 12.45°$

$h = (R_1 + R_2)\sin\Delta_1$

$R_1 + R_2 = \frac{h}{\sin\Delta_1}$

$= \frac{110}{\sin 12.45°}$

$\therefore R_1 + R_2 = 510.23m$

$\therefore R_2 = 510.23 - R_1$

$= 510.23 - 200$

$R_2 = 310.23m$

length of 1st Curve, $l_1 = \frac{\pi R_1 \Delta_1}{180°} = \frac{\pi \times 200 \times 12.45}{180}$

$l_1 = 43.46m$

length of 2nd Curve $l_2 = \frac{\pi R_2 \Delta_1}{180°} = \frac{\pi \times 310 \times 23 \times 12.45}{180}$

$l_2 = 67.41m$

Q7.a. VERTICAL PHOTO GRAPH.

is an aerial photograph made with camera axis (or optical axis) coinciding with direction of gravity

TILTED PHOTOGRAPH

is an aerial photograph made with camera axis (or optical axis) unintentionally tilted from the vertical by a small amount (< 3°).

OBLIQUE PHOTOGRAPH.

is an aerial photograph taken with camera axis intentionally directed between the horizontal & vertical.

Q7.b. Scale at any height h is given by

$$S_h = \frac{f}{H-h}$$

i) Elevation = 80m

$$S_{80} = \frac{f}{H-h} = \frac{15cm}{(1200-80)m} = \frac{1cm}{74.67m}$$

i.e 1cm = 74.67m

1 in 7467m

ii) Elevation = 300m

$$S_{300} = \frac{f}{H-h} = \frac{15cm}{(1200-300)m} = \frac{1cm}{60m}$$

i.e 1cm = 60m

1 in 6000m

Q.2 The reasons for keeping overlap are

1) To tie the different points together accurately it is desirable that principal point of each point should appear on the edges of as many adjacent strips as possible.

2) If the overlap > 50%, the distortions & displacement can be overcome quite effectively while constructing maps.

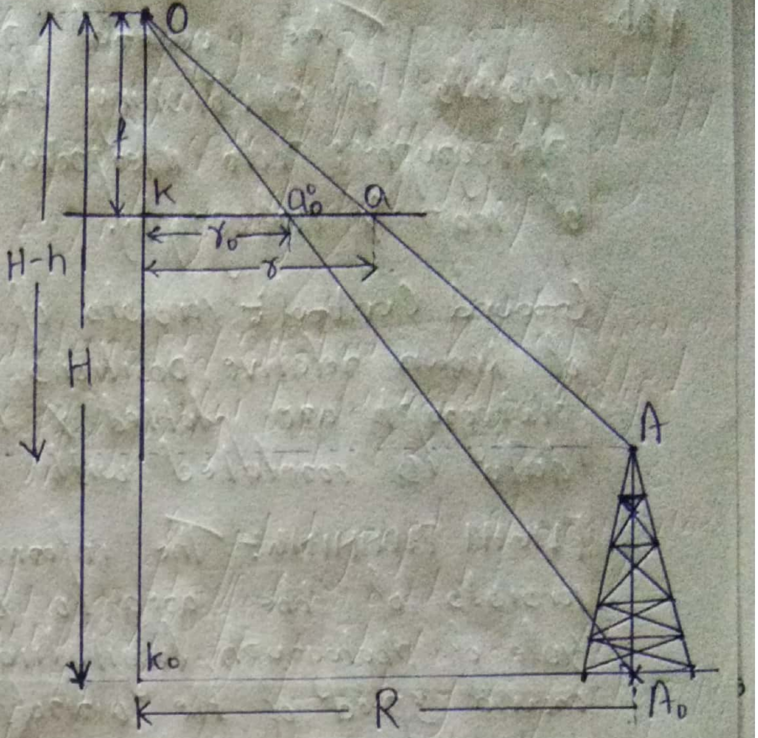
3) In order to view the pair of photograph stereoscopically only the overlapped portion is useful.

4) Due to overlap, each portion of territory is photographed 3 to 4 times. Hence picture with heavy ditortions can be rejected.

5) If the flight lines aren't maintained straight & parallel the gape b/w adjacent strips will be left.

6) In the stereoscopic examination, objects can be viewed from more than one angle if sufficient overlap is provided.

Q8.a.



Let

$r \rightarrow$ radial dist of 'a' from k

$r_0 \rightarrow$ radial dist of 'a_0' from k

$R = k_0 A_0$.

From similar Δ^{les}

$$\frac{f}{H-h} = \frac{r}{R}$$

$$\Rightarrow r = \frac{Rf}{H-h}.$$

Also we have

$$\frac{f}{H} = \frac{r_0}{R}.$$

$$\Rightarrow r_0 = \frac{Rf}{H}.$$

Hence relief displacement (d) is given by

$$d = r - r_0 = \frac{Rf}{H-h} - \frac{Rf}{H} = \frac{Rfh}{H(H-h)}. \rightarrow ①$$

But, $R = \frac{r(H-h)}{f} = \frac{r_0 H}{f}$

Substituting these values in eqn ①.

$$d = \frac{r\cancel{(H-h)}}{\cancel{f}} \frac{\cancel{f}h}{H\cancel{(H-h)}} = \frac{rh}{H}. \quad \therefore d = \frac{rh}{H}.$$

$$\text{Also, } d = \frac{r_0\cancel{H}}{\cancel{f}} \frac{\cancel{f}}{\cancel{H}(H-h)} \quad \therefore d = \frac{r_0 h}{H-h}.$$

Q8b. The general procedure of an aerial survey consists of establishing ground control; flight planning & photography; photo interpretation & stereoscopy; & construction of map & cartography.

Ground Control:- consists of establishing a framework of points, of known relative positions, around which details in the photograph are plotted & through which the photographic data is corelated with the terrain surveyed.

FLIGHT PLANNING:- The information required to plan a flight consists of the area to be surveyed, focal length of camera, scale of photograph, longitudinal and side overlap & approximate ground speed of the aircraft in still air.

PHOTO INTERPRETATION:- means identifying & recognising objects in the aerial photograph & then judging their significance in the photograph.

STEREOSCOPY: The principle of it is similar to binocular vision enabling an observer to view an object or to be more precise, 2- different perspectives of an object, so as to obtain therefrom mental impression of 3D image.

Q8c. Given, $L_1 = 20km$ $L_2 = 16km$ $P_l = 0.6$ $P_w = 0.3$ $s = 150$

$l = 250mm = 25cm = w$

No. of photograph in each strip, $N_1 = \frac{L_1}{(1-P_l)sl} + 1 = \frac{20000}{(1-0.6)\times150\times25} + 1$

$\therefore N_1 = 14.33 \simeq 15$.

No of flight lines required; $N_2 = \frac{L_2}{(1-P_w)sw} + 1 = \frac{16000}{(1-0.3)\times150\times25} + 1$

$N_2 = 7.1 \simeq 8$.

No of photographs required, $N = N_1 \times N_2 = 15 \times 8 = 120$.

Q9.a. Remote sensing is broadly defined as the science & art of collecting information about objects, or phenomena from distance w/o being in physical contact with them.

The different stages of remote sensing S/m are.

1) ENERGY SOURCE :- The passive RS S/m relies on sun as the source of EM energy.
The active RS S/m use their own source of energy.

2) PROPOGATION OF ENERGY FROM ATMOSPHERE :- The EM energy from the source pass through the atmosphere on its way to earth's surface. Also after reflection it again passes through the atmosphere on its way to sensor.

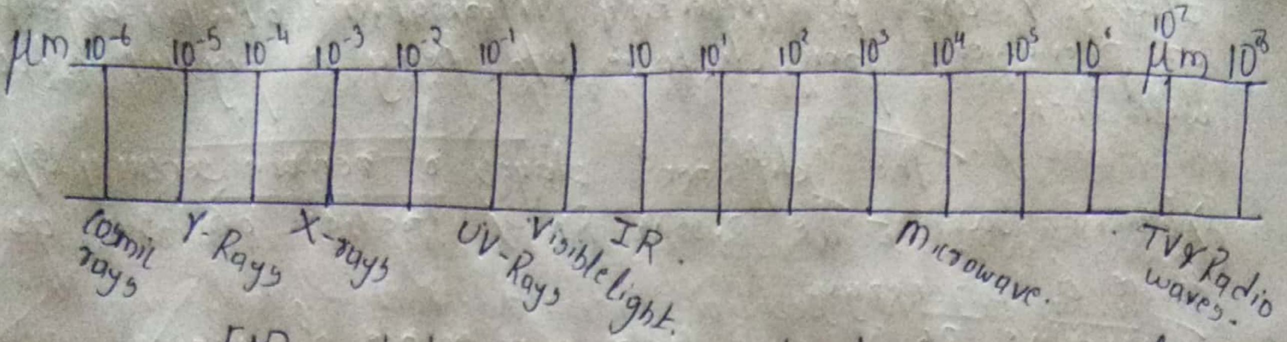
3) INTERACTION OF ENERGY WITH SURFACE FEATURES OF EARTH :- generates reflected or emitted signals (Spectral response pattern or signature) which plays a central role in detection, identification & analysis of earth's surface material.

4) AIRBORNE / SPACE BORNE SENSORS :- are EM instruments designed to receive & record retransmitted energy. The sensors are highly sensitive to wavelengths, yielding data on the absoluted brightness from the object as a function of wavelenght.

5) TRANSMISSION OF DATA TO EARTH STATIONS & DATA PRODUCT GENERATION
The data from sensors are transmitted to ground based earth station along with the telemetry data. The data product can be classified as i) PICTORIAL / PHOTOGRAPHIC product ii) DIGITAL product.

6) MULTIPLE - DATA USERS :- are those who have knowledge of great depth of their respective disciplines as well as of remote sensing data & analysis techniques.

Q9.b.



EM radiation can be produced at a range of wavelength & can be categorised according to its position into discrete regions which is generally referred to EM spectrum.

EM spectrum is continuum of energy that ranges from m' to nanometers in wavelengths travels at speed of light & propagates through vaccum.

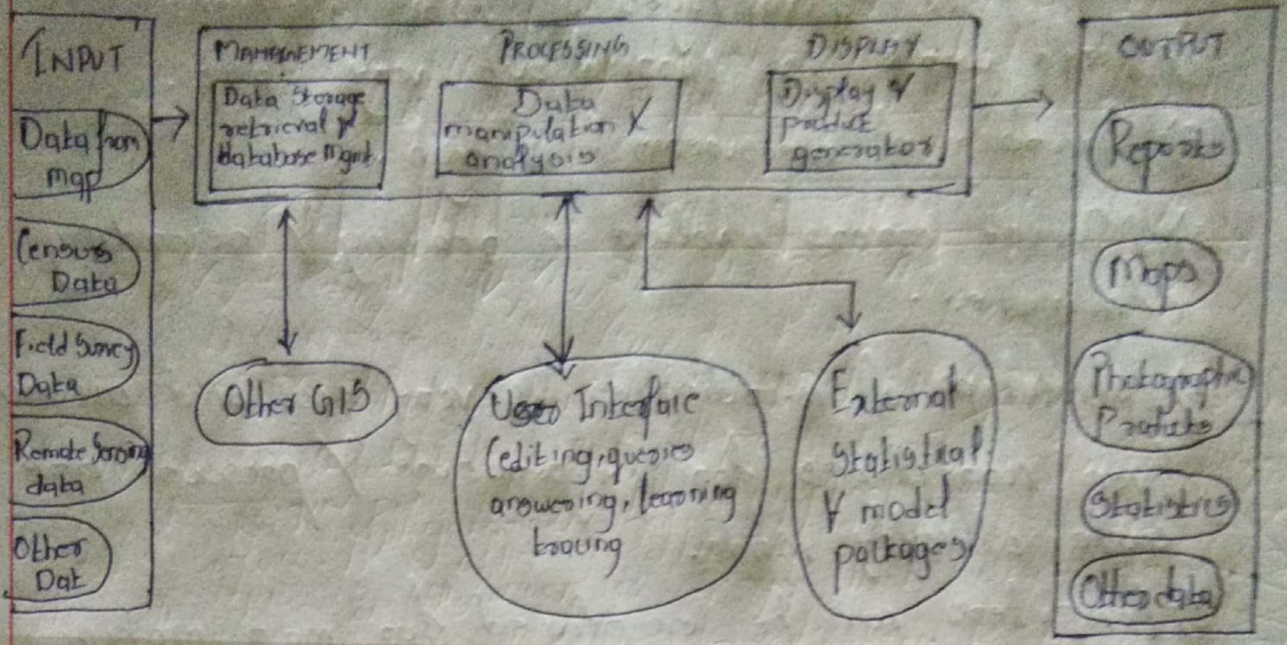
All matter radiates a range of electromagnetic energy.

The wavelengths & frequencies vary from (shorter wavelength-high frequency-cosmic waves) to (long wavelength-low frequency-radio waves).

Earth's atmosphere absorbs energy in gamma ray, X-ray & most of the UV region. Therefore these regions are not used in remote sensing.

Remote sensing deals with energy in visible, infrared, thermal and microwave regions.

Q7.c.



A GIS may be considered ~~to~~ have 5 major components subsystems.

1) INPUT :- deals with creating an image-based GIS from multigeodatasets.

2) MANAGEMENT :- purpose is efficient storage, retrieval & database management.

3) PROCESSING :- Data manipulation, feature enhancement & classification, etc.

4) DISPLAY :- Display & product generation.

5) OUTPUT :- provides thematic maps, images etc for application.

Q10a. The advantages of total stations are

1) Field work is carried out very fast.

2) Accuracy of measurement is high.

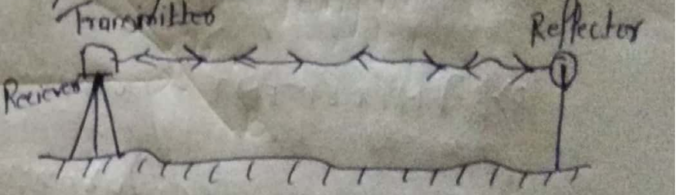
3) Manual errors involved in reading & recording are eliminated.

4) Calculation of co-ordinates is very fast and accurate. Even corrections for temperature & pressure are automatically made.

5) Computers can be employed for map making & plotting contour & cross-sections. Contour intervals & scales can be changed in no time.

The working principle of total station is.

That the total station emits EM energy which hits the reflector & gets collected by the reciever in total station.



The total station calculates either

i) time taken by wave to travel from transmitter, hit reflector & collected back by reciever. or

ii) phase difference b/w the transmitted & reflected signals.

Q10.b. The advantages of LIDAR technology are

1) RESOLUTION & ACCURACY: LIDAR generates instantaneous, massive amounts of measurements & can be accurate to a cm.

2) 3D-MAPPING: LIDAR data can be easily converted into 3D maps to interpret the environment.

3) LOW LIGHT PERFORMANCE: LIDAR is unaffected by ambient light variations & performs well in low light conditions.

4) SPEED: LIDAR data are direct distance measurements that dont need to be deciphered or interpreted - thus enabling faster performance & reducing processing requirement.

Q10.c. GPS is a space based all weather radio navigation s/m that provides quickly, accurately & inexpensively the time, position & velocity of the object anywhere on the globe at any time.

The basic principle of GPS is that it measures either time taken or phase difference b/w the electromagnetic wave emitted by the transmitter & recieved by the receiver. Then calculating calculating the distance.

The application of GPS in Surveying are

1) GPS can be used for topography, radial & linear stakeout, cut/fill, corrections to sealevel, curvature & refraction.

2) GPS can measure coastal deformations, post glacial rebound, volcanic uplift, plate tectonics & earth rotation.

3)

3) The accurate positioning through GPS enables the development of precise seismic maps & location of drill sites with respect to geological structure.

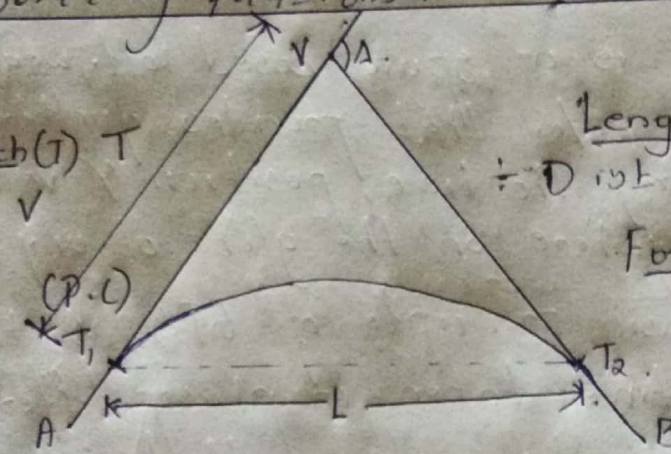
4) GPS is very useful when beginning the survey, in locating boundaries & control markers that may be covered by snow or other ground covers.

5) GPS is very useful for layout works, One base receiver supported by many rover receivers permit the instantaneous layout of boundaries, pipelines, roads & building locations.

Q5.c.

Tangent Length(T) T :- Dist b/w T_1 & V

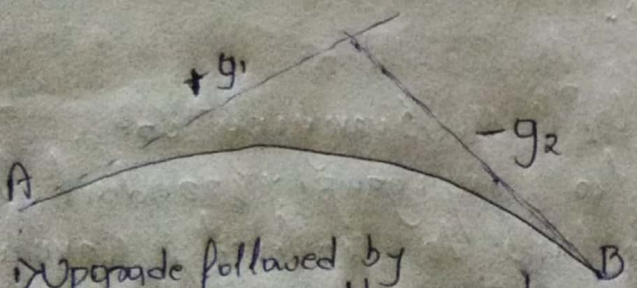
Point of Curve (PC) or (T_1) :- Start point of curve



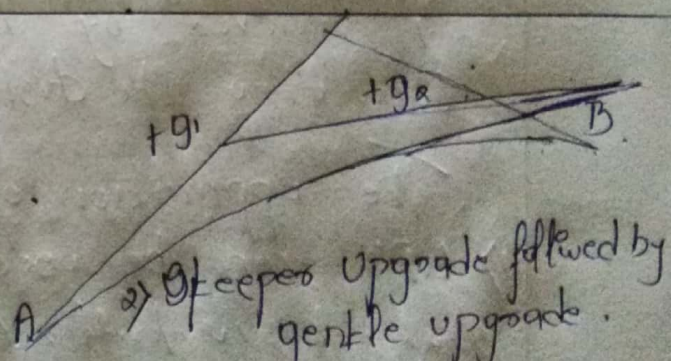
Length of Long Chord (L) :- Dist b/w T_1 & T_2

Forward Tangent: T_2B. Tangent to the end point of curve.

Q6.c.

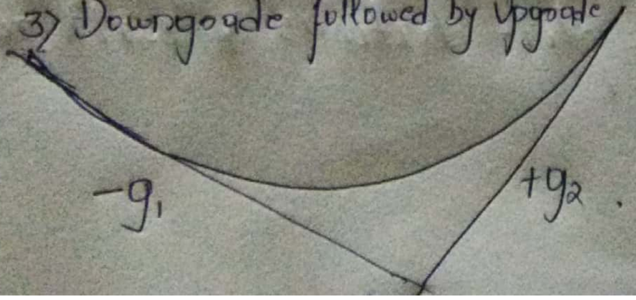


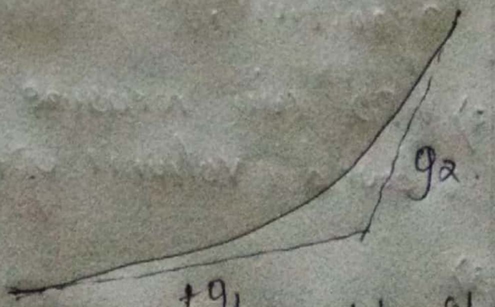
1) Upgrade followed by Downgrade.



2) Steeper Upgrade followed by gentle upgrade.

3) Downgrade followed by Upgrade





4) Upgrade followed by steeper upgrade.