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(REVISION — 2015)

Reg. No. ....

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THIRD SEMESTER DIPLOMA EXAMINATION IN CIVIL ENGINEERING — APRIL, 2017

SURVEYING – II

[*Time* : 3 hours

(Maximum marks : 100)

PART — A

(Maximum marks : 10)

Marks

I Answer the following questions in one or two sentences. Each question carries 2 marks.

1. Distinguish between face left and face right observations.
2. Define latitude of a survey line.
3. State different types of vertical angles.
4. List the methods of setting of simple curve.
5. Define photogrammetry. (5×2 = 10)

PART — B

(Maximum marks : 30)

II Answer *any five* questions from the following. Each question carries 6 marks.

1. State relationships between the fundamental lines of transit theodolite.
2. Explain double sighting method prolonging straight line.
3. The interior angles of traverse ABCDE are measured as follows.
   ∠A=75°40′40″, ∠B=120°15′, ∠C=98°16′20″, ∠D=125°50′40″, ∠E=119°57′20″
   The bearing of AB is 215. Find out the bearing of remaining sides of traverse.
4. Explain the procedure of measuring vertical angle.
5. A theodolite was set up a distance of 50m from a chimney and the angle of elevation to its top was 19°40′00″. The staff reading on BM of RL 43.7 with telescope horizontal was 0.865m. Find the reduced level of top of chimney.
6. Write any six elements of simple curve.
7. Explain how remote sensing works in water resources and detection of water pollution. (5×6 = 30)

Marks

PART — C

(Maximum marks : 60)

(Answer *one full* question from each unit. Each full question carries 15 marks.)

UNIT — I

III (a) Explain the measurement of horizontal angle by repetition method. 7

(b) Describe the following the component parts of a transit theodolite.

(i) Telescope

(ii) Lower plate and upper plate

(iii) Standards 8

OR

IV (a) Explain measuring of magnetic bearing of a survey line with a transit theodolite. 7

(b) Define permanent adjustment of a transit theodolite and describe the testing and adjustment of line of collimation and horizontal axis of a theodolite. 8

UNIT — II

V (a) Explain the procedure for theodolite traversing by deflection angle method. 7

(b) The following corrected latitudes and departures corresponded to the sides of a travers ABCDE. Compute the independent co-ordinate.

Line	*Latitude*		*Departure*	
	Northing	Southing	Easting	Westing
AB		324.20	620.25	
BC	450.35		947.00	
CD	979.25			743.00
DE		537.00		798.80
EA		568.40		25.45

8

OR

VI (a) Explain the procedure for calculating bearing and length of traverse whose length and bearing of one side are missing. 7

(b) The length and bearing of a traverse ABCD are observed as follows. Compute the length and bearing of line DA.

Line	*Length*	*WCB*
AB	470	336°20′
BC	1780	15°20′
CD	1080	140°36′

8

(2)

Marks

UNIT — III

VII (a) Derive an expression for find out the distance D when instrument axis at same level and base of object inaccessible. 7

(b) Find the reduced level of top of electric tower from the following data.

Instrument station	Reading on BM	Vertical angle	RL of BM	Distance in m	Remark
A	1.725	12°42′			A&B are in
B	1.410	9°24′	175.50	30m	Line with top of electric tower

8

OR

VIII (a) Describe the procedure for determine the tacheometric constant of a tacheometer in the field. 7

(b) A tacheometer with multiplying constant 100 and additive constant zero was set over a station P and the staff reading on a staff held vertical over point Q were 1.450, 1.650, 1.850 and vertical angle was – 6°25′. The RL of P was 250.000m and HI at station P was 1.690m. Calculate distance PQ and reduced level of Q. 8

UNIT — IV

IX (a) State the requirement of transition curve. 7

(b) A simple curve has a radius of 565m. The tangent intersect at the chainage of 1020m and the angle of intersection is 120°00′. Find the following.

(i) Tangent distance

(ii) Chainage at beginning and end of the curve

(iii) Length of the curve

(iv) Degree of the curve 8

OR

X (a) State the principles of EDM instrument. 5

(b) Mention the importance of map projection data entry. 5

(c) List the application in civil engineering using remote sensing. 5

③

Third semester Diploma Examination in CIVIL ENGINEERING - APRIL 2017

Surveying II - Answer key

I 1) Face left observation

If the face of the vertical circle is to the left of the observer, the observation of the angle (horizontal or vertical) is known as face left observation.

Face right observation

If the face of the vertical circle is to the right of the observer, the observation is known as face right observation.

2) The latitude of survey line may be defined as its co-ordinate length measured parallel to the meridian direction.

3) NIL

4) The methods of setting out curves can be mainly divided into two heads depending upon instruments used.

(i) Lineal methods :

- Only a chain or tape is used.
- used when
  (a) high degree of accuracy is not required.
  (b) curve is short.

(ii) Angular methods

- an instrument such as a theodolite with or without a chain (or tape).

5) Photogrammetric surveying or photogrammetry is the science & art of obtaining accurate measurements by use of photographs, for various purposes such as construction of planimetric and topographic maps, classification of soils, interpretation of geology, acquisition of military intelligence & the preparation of composite pictures of the ground.

II

Part B

1) Relationship

(i) The axis of the plate level must lies in a plane perpendicular to the vertical axis.

(ii) The line of collination must be perpendicular to the horizontal axis at its intersection with vertical axis.

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

(iv) The axis of the altitude level must be parallel to the line of collimation.

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

(vi) The axis of the stridup level must be parallel to the horizontal axis.

2) Prolong a straight line

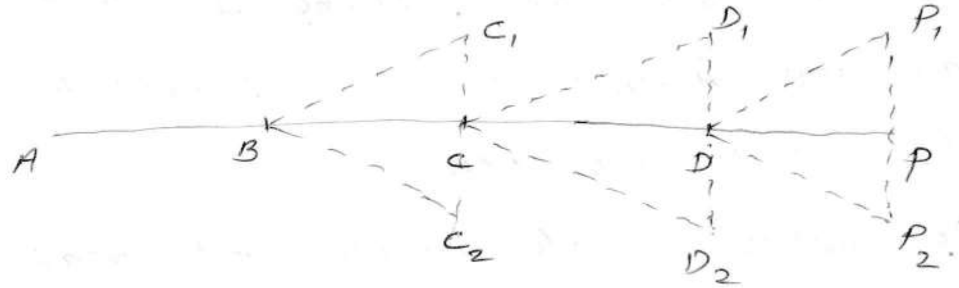
1st method

Set the instrument at A and sight B acurately. Establish a point C in the line of sight. Shift the instrument at B, sight C and establish point D. The process is continued until P is established.

Second method

Set the instrument at B and take a back sight on A. Plunge the telescope and establish a point C_1. Change face, take a back sight on A again, and plunge the

If the instrument is in adjustment c_1 & c_2 will coincide. If not, establish c midway between c_1 & c_2. Shift the instrument to c and repeat the process. The process is repeated until P is reached. This method is known as double sighting.



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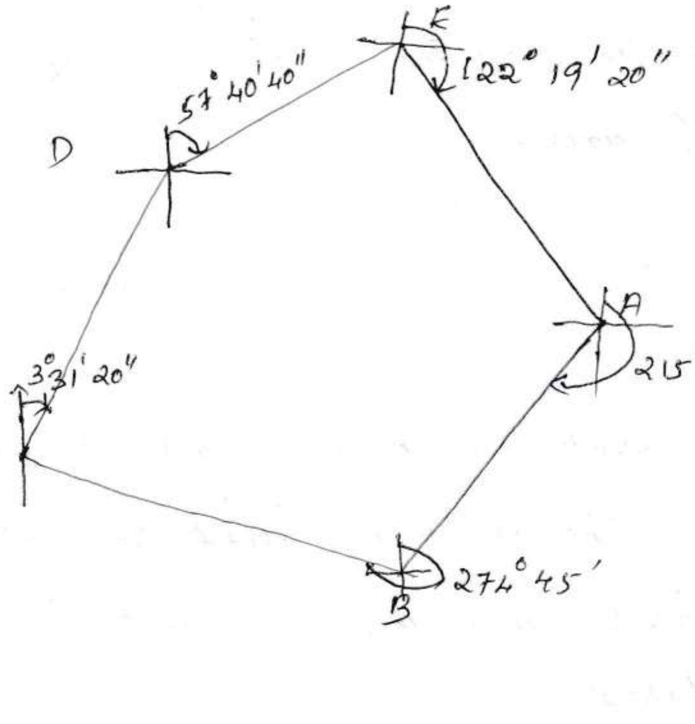


4) Measuring a vertical Angle :

A vertical angle is an angle b/w the inclined line of sight & the horizontal. It may be an angle of elevation or depression according as the object is above or below horizontal plane.

To measure vertical angle of an object A at a station O,

(i) Set up theodolite at station-point O & level it accurately with reference to the altitude bubble.

(ii) Set up the zero of vertical vernier exactly to the zero of the vertical circle by using vertical circle clamp & tangent screw.

(iii) Bring the bubble of the altitude level in the central position by using clip screw. The line of sight is thus made horizontal, while vernier reads zero.

(iv) Loosen the vertical circle clamp screw & direct the telescope towards the object A & sight it exactly by using vertical circle tangent screw.

(v) Read both verniers on vertical circle. The mean of the two vernier readings gives the value of required angle.

(vi) Change the face of the instrument and repeat the process. The mean of two vernier readings gives second value of required angle.

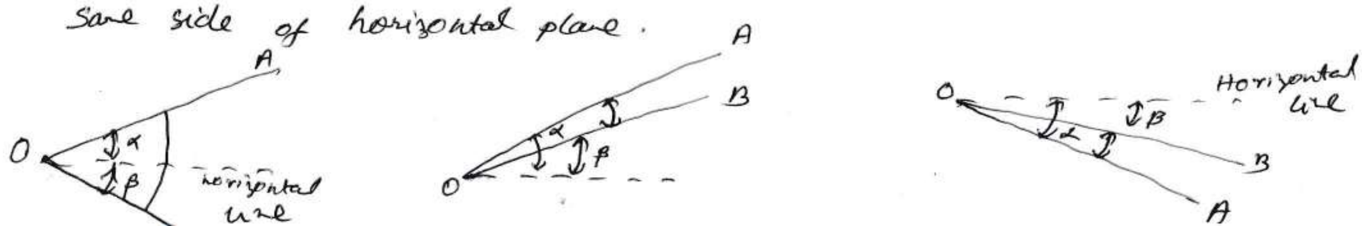
(vii) The average of two values of angle thus obtained, is required value of angle free from instrumental errors.

To measure the vertical angle b/w two points A & B

(i) Sight A as before, & take the mean of two vernier readings at the vertical circle. Let it be α.

(ii) Similarly sight B & take the mean of two vernier readings at the vertical circle. Let it be β.

(iii) The sum or difference of these readings will give the value of the vertical angle b/w A & B according as one of the points is above & other is below the horizontal plane or both points are on same side of horizontal plane.



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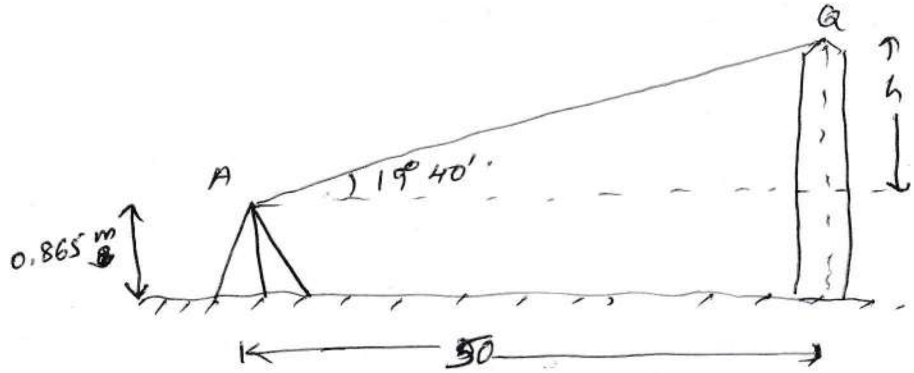


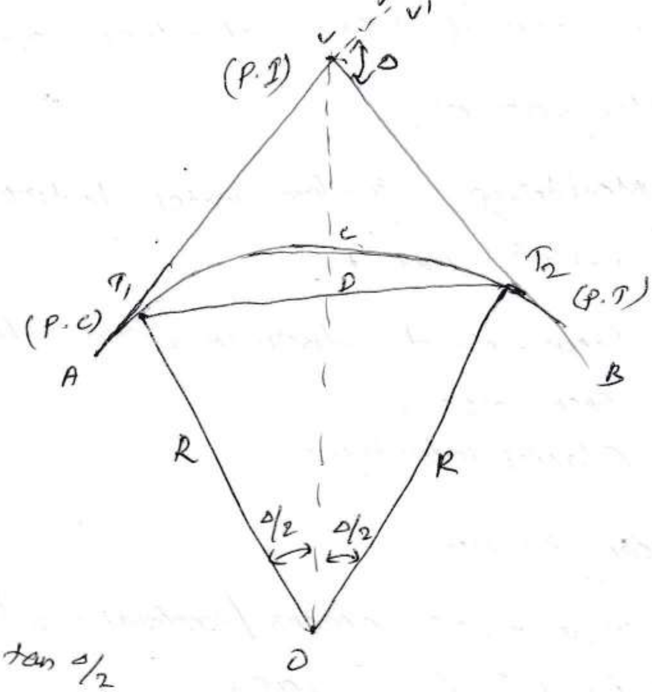
RL of Q = R.L of BM + S + D tan α

= 43.7 + 0.865 + 50 tan 19°40'

= 62.44 m

(6)

6) A simple curve is the one which consists of a single arc of a circle. It is tangential to both the straight lines.



Elements

(i) Length of curve (l)

$l = T_1 C T_2 = R\Delta$

where Δ is in radians $= \frac{\pi R}{180}\Delta$

where Δ is in degrees.

~~(a) Arc~~

(ii) Tangent Length (T)

$$T = T_1 V = V T_2 = O T_1 \tan \Delta/2$$
$$= R \tan \Delta/2$$

(iii) Length of long chord (L)

$$L = T_1 T_2 = 2 O T_1 \sin \Delta/2 = 2R \sin \tfrac{1}{2}\Delta$$

(iv) Apex distance or external distance (E)

$$E = CV = VO - CO = R\sec \Delta/2 - R$$
$$= R(\sec \Delta/2 - 1) = R \text{ exsec } \Delta/2$$

(v) Mid-ordinate (M)

$$M = CD = CO - DO = R - R\cos \Delta/2$$
$$= R(1 - \cos \Delta/2) = R \text{ versin } \Delta/2$$

The mid ordinate of the curve is also known as the versed sine of the curve.

7) Remote sensing affords a practical means for accurate and continuous monitoring of the earth's natural and other resources and of determining the impact of man's activities on water.

Water resources

(i) Monitoring surface water bodies frequently and estimation of their spatial extent.

(ii) Snow - cloud discrimination leading to better delineation of snow area.

(iii) Glacier Industry

Ocean Resources

(i) wealth of oceans / explorations / productivity

(ii) Potential fishing zone.

(iii) Coral reef mapping

(iv) Low tide / high tide marking.

Ocean colour Monitor (OCM) is a payload on board IRS P4 satellite. This sensors has eight spectral bands operating in visible and near IR region.

(7)

Part C

Unit - I

III a) Method of Repetition

(i) Set the instrument at Q and level it. With the help of upper clamp and tangent screw set 0° reading on vernier A. Note reading on vernier B.

(ii) Loose the lower clamp & direct the telescope towards the point P. Clamp the lower clamp & bisect point P accurately by lower tangent screw.

(iii) Unclamp the upper clamp & turn the instrument clockwise about inner axis towards R. Clamp the upper clamp & bisect R accurately with the upper tangent screw. Note the readings of verniers A & B to get the approximate value of angle PQR.

(iv) Unclamp the lower clamp & turn the telescope clockwise to sight P again. Bisect P accurately by using lower tangent screw.

(v) Unclamp the upper clamp, turn the telescope clockwise & sight R. Bisect R accurately by upper tangent screw.

(vi) Repeat the process until the angle is repeated the required number times (usually 3.). The average angle with face left will be equal to final the reading divided by 3.

(vii) Change face & make 3 more repetitions as described above. Find the avg angle with face right, by dividing the final reading by three.

(viii) The avg horizontal angle is then obtained by taking the avg. of two angles obtained with face left & face right.

III (b) (i) Telescope

It may be external focussing and external focussing. The first type is used in older type while later is used in modern instruments. It is mounted near its centre on a horizontal axis at right angles

Lower circular Plate

Carries the circular scale graduated from 0° to 360° to degrees and half degrees or degrees & third of a degree & a tapered spindle which works in the outer conical bearing.

Upper plate

The centre of vertical spindle of lower plate is bored to form a bearing for an other vertical spindle which carries the upper circular horizontal plate. It can be rotated relative to the lower plate about this spindle as axis. This plate carries a level tube & two vertical standards for supporting telescope, vertical circle and detachable compass.

IV
(b) Permanent adjustments are made to establish the fixed relationship b/w the fundamental lines of the instrument, once they last for long time. They are essential for the accuracy & observations.

(i) Adjustments of the horizontal Plate Levels.

The axis of the plate levels must be ⊥r to the vertical axis.

(ii) Collimation Adjustment.

The line of collimation should coincide with the axis of the telescope & the axis of the objective, slide & should be at right angles to the horizontal axis.

(iii) Horizontal axis adjustment.

It must be ⊥r to the vertical axis.

(iv) Adjustments of telescope level or the altitude level.

The axis of telescope level or altitude level must be parallel to the line of collimation.

(v) ~~Level~~ vertical circle Index Adjustment

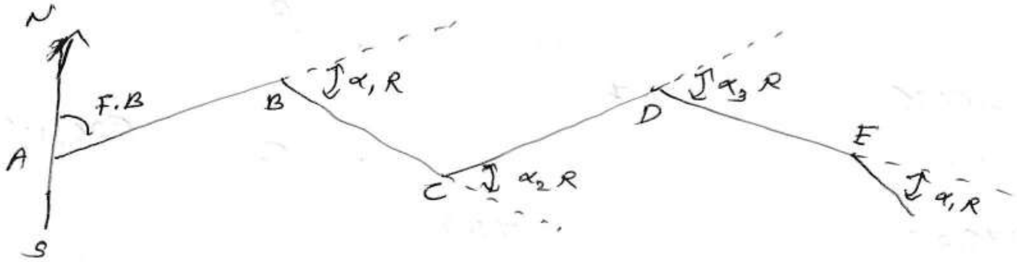
vertical circle vernier must read zero when the line of collimation is horizontal.

Unit II

(8) i)

(a) Traversing by method of deflection angles

This method is used for open traverses. Suitable when the survey line make small deflection angles with each other as in the case of survey for roads, railways, pipe lines etc..



From fig, set up the theodolite at starting station A & observe the bearing of line AB. Shift the instrument to station B, set the vernier A to zero & take a back sight on A. Then transit the telescope, loosen the upper clamp, turn the telescope clockwise & take a fore sight on C. Read both verniers, the mean of these readings is the required deflection angle of BC from AB. Also note down its direction. In this case, it is α_1R (ie, α_1 Right). Then set up the theodolite at each of the successive stations, C, D, E etc.. & observe the deflection angles, and record them in the field book. Chaining & offsetting is done in usual manner.

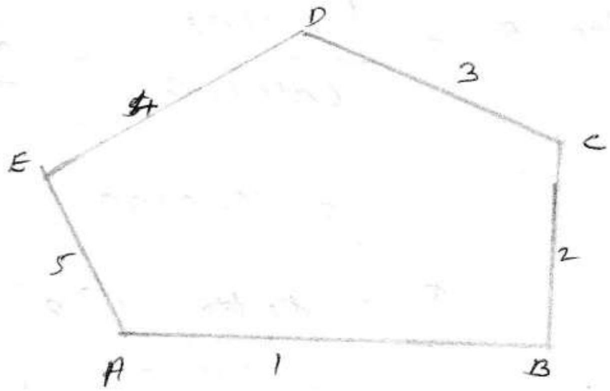
V (b)

Line	Lattitude N	Lattitude S	Departure E	Departure W	Station	Total coordinates N	Total coordinates E
					A	400 assumed	400 assumed
AB		324.2	620.25		B	75.8	1020.25 ~~1220.25~~
BC	450.35		947		C	526.15	73.25
CD	979.25			743	D	-10.85	725.55
DE		537		798.8	E	-579.25	751
EA		568.4		25.45			

(9)

VI

a) Let from fig, let it be required to calculate either bearing or length ~~of both bearing~~ of line EA. Calculate $\Sigma L'$ and $\Sigma D'$ of four known sides AB, BC, CD and DE, then



ΣL = Lattitude of EA $+ \Sigma L' = 0$

Lattitude of EA $= -\Sigma L'$

Similarly

ΣD = Departure of EA $+ \Sigma D' = 0$

Departure EA $= -\Sigma D'$

Knowing latitude & departure of EA, its length & bearing can be calculated by proper trignometrical relations.

VI

(b)

Line	Lattitude +	Lattitude −	Departure +	Departure −
AB	430.47			188.67
BC	1716.64			470.69
CD		834.56	685.51	
Sum	2147.11	834.56	685.51	659.36
	$\Sigma L' = +1312.55$		$\Sigma D' = +26.15$	

~~tan θ =~~

Latitude of DA = − 1312.55 m

~~to~~ Departure of DA = − 26.15 m

$$\tan\theta = \frac{\text{Departure}}{\text{Latitude}} = \frac{26.15}{1312.55}$$

$$= 0.0199$$

$$\theta = 1^\circ 8' 28''$$

Bearing of DA = $180^\circ + \theta$ = $181^\circ 8' 28''$

Length of DA :-

$$l \cos\theta = \text{Latitude}.$$

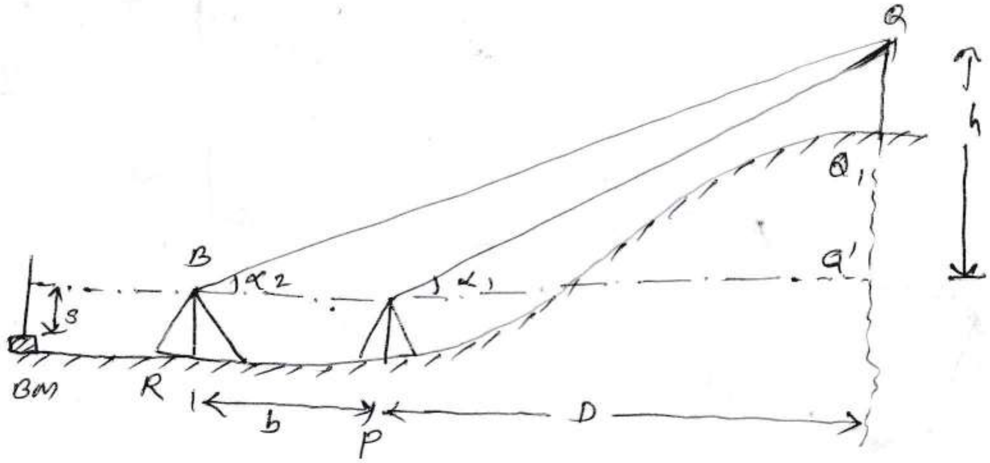
$$l \cos 181^\circ 8' 28'' = -1312.55$$

$$l = 1312.8 \text{ m}.$$

(10)

VII

(a) Base of the object inaccessible ; Instrument stations in the same vertical plane as elevated object



If the horizontal distance b/w the instrument & object can be measured due to obstacles etc.. two instrument stations are used so that they are in the same vertical plane as the elevated object.

Procedure

(i) Set up theodolite at P & level it accurately with respect to altitude bubble.

(ii) Direct the telescope towards Q & bisect it accurately. Clamp both plates. Read vertical angle α_1.

(iii) Transit the telescope so that the line of sight is reversed. Mark second instrument station R on ground. Measure distance RP accurately.

(iv) Shift instrument to R & set up theodolite there. Measure vertical angle α_2 to Q with both face observations.

(v) With the vertical vernier set to zero reading, the altitude bubble in the centre of its run, take the reading on staff kept at nearby BM.

$h = QQ'$

$\alpha_1 \rightarrow$ angle of elevation from A to Q

$\alpha_2 \rightarrow$ angle of elevation from B to Q

$b \rightarrow$ horizontal distance b/w instrument stations

$S \rightarrow$ staff reading on BM, taken from both A & B

$D \rightarrow$ horizontal distance b/w P & Q

From Δ^{le} AQQ', $h = D \tan\alpha_1$ ——— (1)

From Δ^{le} BQQ', $h = (b+D)\tan\alpha_2$ ——— (2)

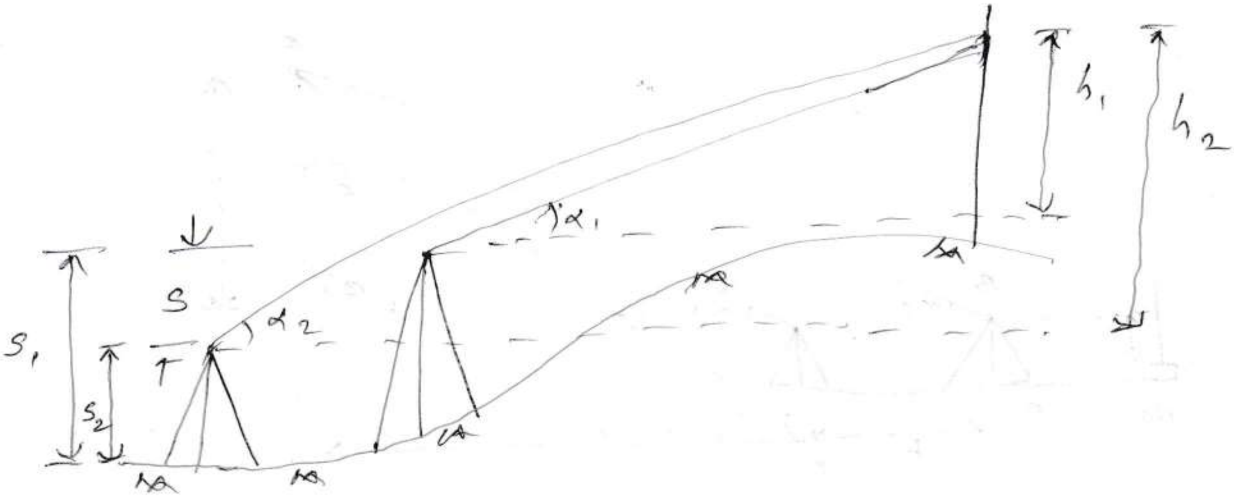
Equating (1) & (2),

$D\tan\alpha_1 = (b+D)\tan\alpha_2$ or $D(\tan\alpha_1 - \tan\alpha_2) = b\tan\alpha_2$

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

Q VII

(b) ~~S = 1.578 − 1.269 = 0.30~~



$S = 1.725 - 1.410 = 0.315$

$$D = \frac{(d - S\cot\alpha_1)\tan\alpha_2}{\tan\alpha_1 - \tan\alpha_2}$$

$$= \frac{(30 - 0.315 \times \cot 12^\circ 42')\tan 9^\circ 24'}{\tan 12^\circ 42' - \tan 9^\circ 24'}$$

$\simeq 80.8\ m$

$h_1 = D \tan\alpha_1$

$= 80.8 \tan 12^\circ 42'$

$= 17.8\ m$

$h_2 = D + d\tan\alpha_2$

$= 80.8 + 30\tan 9^\circ 24' = 85.68\ m$

RL of Q = RL of BM + S_1 + h_1

= 175.50 + 1.725 + 17.8

= 195.025 m

(11)

viii)

(a)

(i) Set up the instrument at a station P on a flat ground.

(ii) Select another point Q about 100 m away measure the distance b/w P & Q acurately with a steel tape. Drive pegs at uniform interval say 25 m, along PQ marks the peg points as 1, 2, 3 & drive peg at Q or at station Q.

(iii) Keep the staff on the peg A and obtained the staff intercept

(iv) Like wise obtain the staff intercept S_2 when the staff is kept at the peg 2.

(v) From simultaneous equation

$$D_1 = kS_1 + c \quad \text{——— (a)}$$

$$D_2 = kS_2 + c \quad \text{——— (b)}$$

(261)

Solving equation (a) & (b)

$$k = \frac{D_2 - D_1}{S_2 - S_1}$$

From (a)

$$c = D_1 - \left[\frac{D_1 - D_2}{S_2 - S_1}\right] S_1$$

$$= \frac{D_1 S_2 - D_2 S_1}{S_2 - S_1}$$

From another set of simultaneous equation after obtaining staff intercept S_3 & S_4 at the peg 3 & point Q.

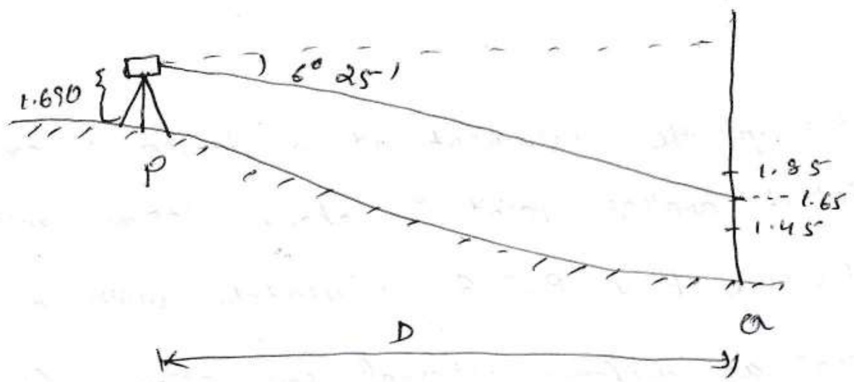
$$k = \frac{D_4 - D_3}{S_4 - S_3} \quad , \quad c = \frac{D_3 S_4 - D_4 S_3}{S_4 - S_3}$$

viii (b)

RL of P = 250 m

$\frac{f}{i} = 100$

$f+d = 0$



$D = \frac{f}{i} s \cos^2 \alpha + (f+d) \cos \alpha$

$= 100 \times 0.2 \times \cos^2 6° 25'$

$= 19.75 \text{ m}$

$V = \frac{f}{i} s \cos \alpha \sin \alpha + (f+d) \sin \alpha$

$= 100 \times 0.2 \times \cos 6° 25' \times \sin 6° 25'$

$= 2.22 \text{ m}$

RL of Q = RL of P + h − V − r

$= 250 + 1.690 - 2.22 - 1.45$

$= 248.02 \text{ m}$

(12)

IX

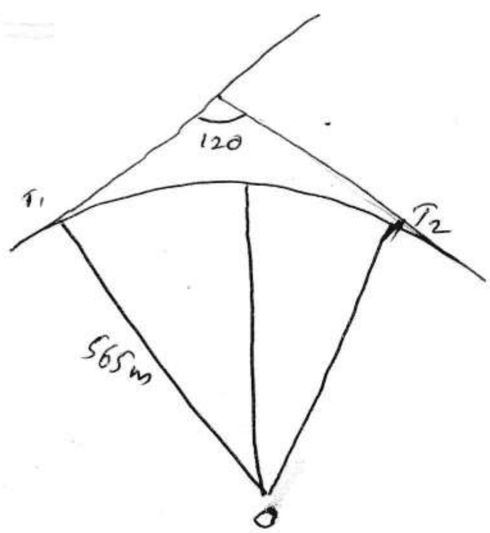
a) A transition ~~or~~ curve is a curve of varying radius ~~constructe~~ introduced b/w a straight and a circular curve or between 100 branches of a compound curve or reverse curve. The transition curve full fill the following conditions

- It should be tangential to the straight
- It should meet the circular curve tangentially.
- It's curve should be zero at the origin on straight.
- Its curvature at the junction with the circular curve should be the same as that of circular curve.
- The rate of increase of curvature along the base should be the same as that of increase of cant or super elevation.
- Its length should be such that full cant or super-elevation is attained at the function with the circular curve.

IX
(b)

Deflection angle = 180 − 120

$= 60^\circ = \Delta$



Tangent distances $= R \tan \Delta/2$

$= 565 \tan \frac{60}{2}$

$= 326.2$ m

Length of the curve

$= \frac{\pi R \Delta}{180} = \frac{\pi \times 565 \times 60}{180} = 592$ m

Chainage at beginning point of commencement

= chainage of point of intersection − Tangent length

$= 1020 - 326.2$

$= 693.8$ m

Chainage of point of tangency

= chainage of point of commencement + length of curve

$= 693.8 + 592$

$= 1285.8$ m

$$\text{Degree of Curve} = \frac{1718.9}{R}$$

$$= \frac{1718.9}{565}$$

$$= 3^\circ 2' 32''$$

(13)
$\bar{x}$

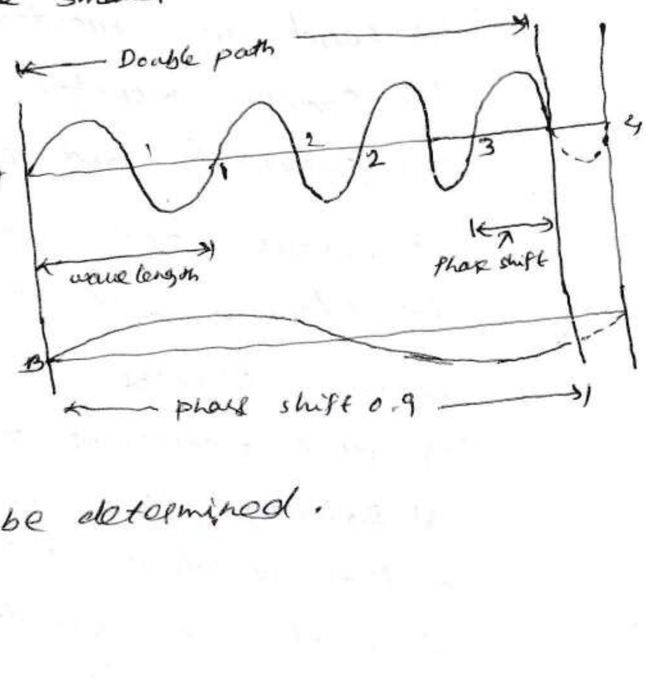
(a) Electromagnetic distance measurement (EDM) enables the accuracies upto 1 in 10^5, over ranges upto 100 km.

EDM is a general term embracing the measurement of distance using electronic methods. The distances are measured with instruments that rely on propagation, reflection & subsequent reception of either radio, visible light or infra-red waves. Geodimeter, Tellurometer and Distomats are the instruments. The type of electromagnetic waves generated depends on many factors but principally on the nature of the electrical signal used to generate the waves.

The principle used in EDM instruments is that the difference in phase b/w the transmitted and received waves represents only a fraction of wavelengths and that by using several wave lengths of varying frequencies the distance can be measured.

Distance (D) = velocity × time = v × t

This can be explained using wavelength. From fig.
Let phase shift be measured as 0.9. The whole no. of wave length measured will be 3.6 (4 × 0.9). The smaller will give more accurate distance.



The electromagnetic waves are transmitted to a retro reflector which returns them to the transmitting instrument. The instrument measures phase shift. By comparison of phase shift b/w transmitted & reflected signals the time and thus the distance can be determined.

(X) (c)

→ Remote sensing gathers and process the information about earth's environment and its natural and cultural resources through Aerial photography & Satellite Scanning.

→ The rock types, lineament, fault or Dyke of geological structures, valley fill with vegetation, black soil cover, salt affected land were some of the applications by using Remote sensing.

Other Applications are

1. Environmental Planning
   a) Provide effective analysis and modelling tools for an environment impact assesment.
   (b) Air/water quality modelling and monitoring
   (c) Coastal management
   (d) waste disposal site locatione
   (e) flood zone mapping.
2. Local & Municipal authorities
   (a) Land use inventory and planning
   (b) Growth monitoring
   (c) Cadastral and parcel mapping
   (d) Census mapping and community development.
   (e) Planning and zoning
3. Transport Planning
   (a) Fleet monitoring and navigation
   (b) Highway design and customisation
   (c) Highway design and customisation.
   (d) Analysis of accident prone areas.

(14)

X (b)

The map is still the most elegant and compact method of displaying spatial data. The role of the map is to communicate spatial information to the user. This information may include location, size, shape, pattern distribution and trends in spatial objects. In designing a map so that it best achieves its objectives, it is necessary to consider a number of key map design elements.