CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐   18 V35

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Basic Surveying

Time: 3 hrs.

Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Define surveying. Discuss the classification of surveying. **(10 Marks)**
   b. What is ranging? Explain the indirect method for ranging with neat sketch. **(08 Marks)**
   c. What is well conditioned triangle? **(02 Marks)**

OR

2 a. Write short notes on optical square and prism square. **(06 Marks)**
   b. A big pond obstructs the chain line such that P and T are on the opposite sides of a pond and line PQ and PR were selected on the left hand side and Right hand side respectively. So that point Q, T and R were in straight line. Find length PT. Take PQ 150m, PR = 230m, QT = 75m, RT = 100m. **(08 Marks)**
   c. Explain briefly chains on slopping ground by stepping method. **(06 Marks)**

Module-2

3 a. Differentiate between :
   i) True meridian and magnetic meridian   ii) Dip and declination   iii) Agonic and isogonic lines. **(06 Marks)**
   b. The following bearings were observed with compass. Calculate the interior angles and draw rough diagram.

Line	AB	BC	CD	DE	EA
Bearing	60°30'	122°0'	46°0'	205°30'	300°

(08 Marks)

   c. What is local attraction? How it is detected and eliminated? Also give the reason for it. **(06 Marks)**

OR

4 a. What is traversing? What are the different types of traversing? **(04 Marks)**
   b. What is closing error? Explain the Bowditch rule of graphical adjustment with sketch. **(08 Marks)**
   c. Following are the observed length and bearings of the lines of a closed traverse ABCDEA. The length and bearing of line EA omitted. calculate it.

Line	Length (m)	Bearings
AB	204	87°30'
BC	226	20°20'
CD	187	280°0'
DE	192	210°30'
EA	?	?

(08 Marks)

18CV3S

Module-3

5 a. Explain the following terms. i) Elevation ii) Benchmark iii) Datum iv) Mean sea level
   (04 Marks)

   b. What do you understand by balancing of sight? With figure explain how the errors are eliminated.
   (06 Marks)

   c. The following is the page of a level book. Find out the missing reading(X) and complete the level book. Apply usual arithmetical check.

Sl.No.	BS	IS	FS	HI	RL	Remark
1	4.000			X	X	
2		X			195.935	
3	2.150		3.995	X	X	
4		2.415			195.240	BM
5		1.665			X	
6		X			200.770	
7	3.610		X	X	X	
8			1.715		196.985	

(10 Marks)

OR

6 a. Write short notes on : i) Curvature and Refraction error ii) Borometric leveling and fly leveling iii) Collimation error and hypsometry.
   (06 Marks)

   b. Describe the procedure for reciprocal leveling with neat sketch.
   (06 Marks)

   c. The following observations were taken in reciprocal leveling. Determine the R.L of B if that of A is 100.150m. Also calculate the collimation error if AB = 1000m.

Inst. Station	Staff reading	
	A	B
A	1.625	2.545
B	0.725	1.405

(08 Marks)

Module-4

7 a. Describe briefly radiation method and intersection method of plane tabling. **(10 Marks)**

   b. Define two point problem. Explain the graphical method of solution of two point problem with figure. **(10 Marks)**

OR

8 a. Write short notes on : i) Orientation of plane table ii) Triangle of error iii) Alidade. **(06 Marks)**

   b. Discuss the temporary adjustments of plane table. **(06 Marks)**

   c. What are the advantages and disadvantages of plane table? **(08 Marks)**

Module-5

9 a. What is contour? What are the uses of contour lines? **(08 Marks)**

   b. A road embankment is 11m wide at the formation level and has side slope 1 : 2(V : H). The ground level at every 80m along centre line are shown in table. The formation level at zero chainage is 123.0 and embankment having a rising gradient 1 : 100 calculate the volume of earthwork by trapezoidal and primordial rule.

Dist.	0	80	160	240	320
RL	120.8	122.5	123.4	123.8	124.5

(12 Marks)

OR

10 a. Define the following terms : i) Contour interval ii) Interpolation of contour iii) Horizontal equivalent v) Contour gradient. **(04 Marks)**

   b. What is planimeter? Explain the polar planimeter along with essential parts. **(12 Marks)**

   c. Determine the area of plan from following data. Needle point out side plan. Zero of dial passed index mark once in clockwise direction : Initial reading = 8.364
   Final reading = 4.234 **(04 Marks)**

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Solution and Scheme for award of marks

AY: 2020-21

Department: Civil Engineering   IA Test No: 1
Subject with Sub. Code: Basic surveying 18CV25   Semester / Division: 1
Name of Faculty: Girish Chalageri.

Q.No.	Solution and Scheme	Marks

MODule –1

Q1 (a)

It is a art of determining the relative position of points on above or beneath the surface of earth by means of direct or indirect measurement of distance, direction & elevation. — ③

Classification :

i) Depending on Nature of field survey.

1) land surveying.
2) Marine survey
3) Astronomical Survey.

ii) Based on Object of survey.

1) Engineering survey.
2) Military survey
3) mine survey.   4) Geological Survey

iii) Based on Instrument Used

1) chain survey   2) Theodolite survey
3) Traverse Survey   4) triangulation Survey
5) plan-Table survey 6) Tacheometry survey
7) Aerial Survey

— ⑧

(b) Ranging : The process of establishing intermediate pt

Q.No.	Solution and Scheme	Marks

in between 2 points is called ranging.

Indirect ranging :

This is applied when 2 ends are intervisible. this meccod applied.
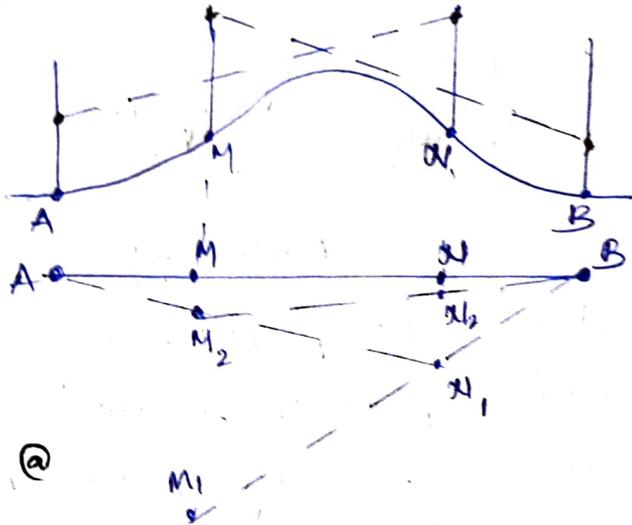
select M_1, N_1 ranging rods. stand @ M_1, move N_1 in say q B. stand @ N_1 move person M_1 till comes between AN_1. mark M_2. stand @ M_2 move N_1 to N_2 between BM_2. following same produce get point M & N on line AB.

— 08

(1) (c) well conditioned triangle :

As triangle is the only simple figure that can be plotted from the lengths q its sides measured in th field. to get good result in plotting, the framework should consist q triangles which are nearly equilateral as possible. usually frame work consist q no q connected triangle. then is called chain triangulation. well conditioned triangles are usually having angle more than 30° q nearly a equilateral triangle.

02

Q 2.
(a) Optical Square.

It is a circular box having
E, F & G as opening.
Let A & B are Mirrors.
Mirror B is having half silvered
@ top & bottom not silvered.
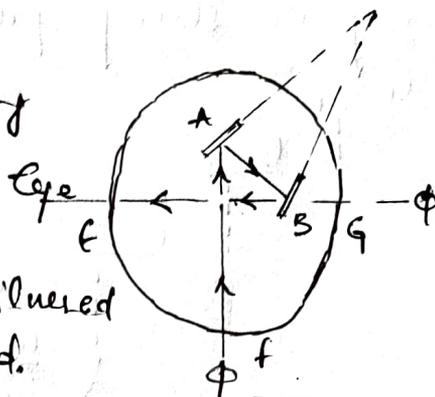
Ray passing from open f move toward,
Mirror A reflect to mirror B. Mirror
B @ top & bottom half is consider as object.
They will get ⊥ line. (bisection) — ③
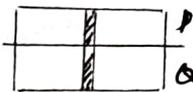
Prism Square !

A & B having Mirrors
from P ray is passed
@ Q object is sighted
from eye slit both get
intersect @ single sight.
they will get bisector of 90°. — ③

(b)
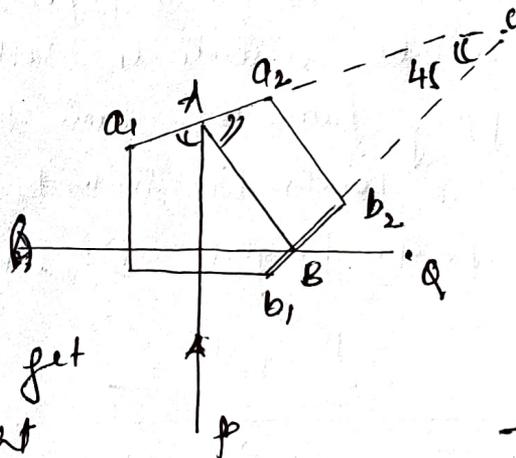
$$\cos\theta = \frac{PR^2 + QR^2 - PQ^2}{2 \cdot PR \times QR}$$

$$= \frac{(230)^2 + (175)^2 - 40^2}{2 \times 230 \times 175} = 0.758$$

from ∆ PTR. $PT^2 = PR^2 + TR^2 - 2 PR \cdot AT \cdot \cos\theta$

$$\boxed{PT = 130 \text{ mts.}}$$

— 04
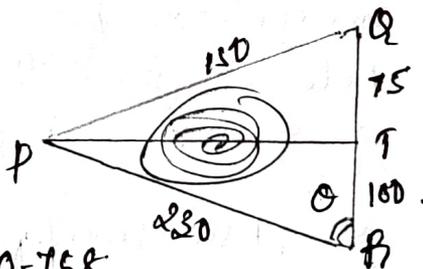
Q.No.	Solution and Scheme	Marks

(c) Chaining on slopey ground by stepped method.
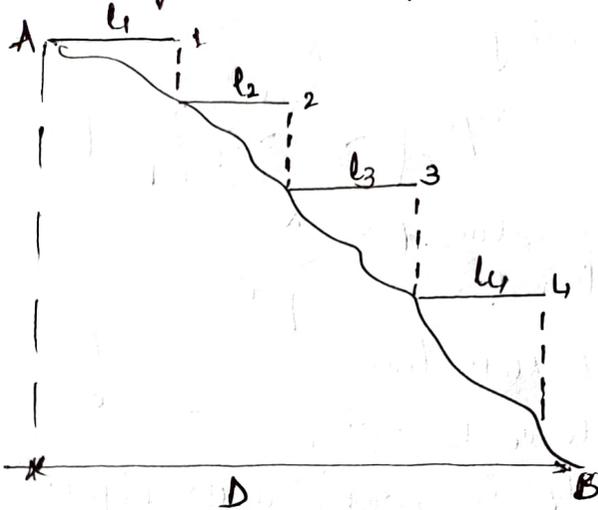
leader moves with arrow & plumb bob with tape One end, Other end tape in with follower (zero) @ suitable distance & marks point 1 @ GL by dropping plumb bob, same steps are followed for further points till reach B finally adding all points lengths $D = l_1 + l_2 + l_3 + l_4$.

— 06

Module 2

3 (a) True meridian: A point on the line in which plane passes through north & south pole intersect with surface of earth.

It is direction shown by freely floating & balanced magnetic needle free from all other attractive forces.

— ②

(ii) Dip: line of force runs from Earth's magnetic field lead from south to north. The angle with these line makes with surface of earth is called Dip.

Declination: It is a horz angle between true meridian & magnetic meridian is called declination.

— ②

Q.No.	Solution and Scheme	Marks

3 a (iii) | Isozonic line : Is the line drawn through the pt of same declination | Agonic line : It is the line made up of points having zero declination. | (2)

(b)
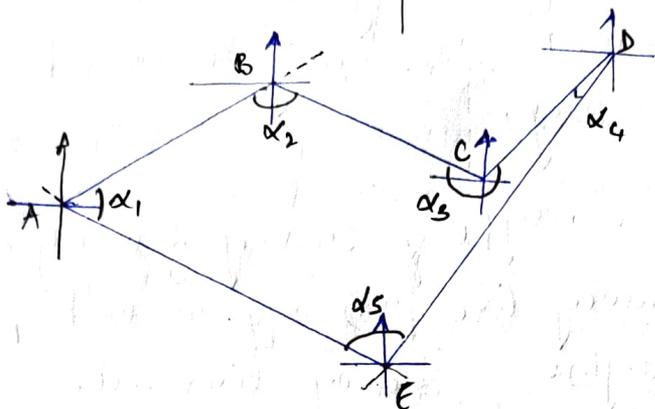
$$\alpha_2 = 60°30' + 180 - 125° = 118°30'$$

$$\alpha_4 = (300 - 180°) - 60°30' = 59°30'$$

$$\alpha_3 = (122° + 180) - 46° = 256°$$

$$\alpha_4 = (46 + 180) - 205°30' = 20°50'$$

$$\alpha_5 = (300° - 200) + (205°30' - 180°) = 85°30'.$$

$$\overline{540°.00}$$ (6)

(6) <u>Local attraction :</u>

It is a term used to denote any influence such as the above which prevents the needle from pointing to the Magnetic North in a given locality.

<u>detection :</u> It can be observed by taking fore & back bearing of each line and finding difference. If difference is 180° then no attraction. If difference is not 180° then station is local attracted

Q.No.	Solution and Scheme	Marks

Elimination :- The amount & direction of error due to local attraction at each of the affected station is found, then the correction is made from mean value of bearing of that line in which there is least discrepancy between back & fore sight reading.

— 06

A (a) Traversing : It is a type of survey in which a no of connected survey line form a frame work & the direction & lengths of survey lines are measured with the help of angle & tape respectively.

Type : (i) Chain traversing (ii) Compass traversing (iii) Transit traversing (iv) plane table traversing.

— 04

(b) Closing Error : If a closed traverse is plotted as per field measurement, the end pt of traverse will not coincide exactly with starting point, owing the error in field measurement of angle & distance such error is called closing error.

Bowditch method : It works an assumption that the error in linear measurement are proportional to $\sqrt{l}$ & error in angular measurement are inversely proportional to $\sqrt{l}$, where l is length of line.

correction to latitude of any side = latitude $\times \dfrac{\text{length of that side}}{\text{perimeter of traverse}}$ total error in

Q.No.	Solution and Scheme	Marks

$$ \text{i) } C_L = \Sigma L \cdot \frac{l}{\Sigma \ell} \quad \& \quad C_D = \Sigma D \cdot \frac{l}{\Sigma l} \qquad \qquad 08 $$

4 (C)

line	Latitude		Departure	
	+ve	−ve	+ve	−ve
AB	8·90		203·8$	
BC	211·92		78·12	
CD	32·48			184·16
DE		165·44		97·44
Sum	253·30	165·44	283·32	281·60
	$\Sigma L' = +87.86$		$\Sigma D' = +0.72$	

line AB Latitude $\ell_1 \cdot \cos\theta_1 = 204 \times \cos(87\cdot30')$

$= 8\text{-}90.$

$\amalg$ departure $= \ell_1 \cdot \sin\theta_1 = 204 \times \sin(87\cdot30') = 203\cdot8$

Latitude of EA $= -\Sigma L' = -87\cdot86 .$ &

Departure of EA $= -\Sigma D' = -0.72$ since Both are

negative lies in $\underline{NW}$ quadrant.

$\therefore \tan\theta = \dfrac{dep}{lat} = \dfrac{0.72}{87.86} \qquad \therefore \theta = 0°28'$

EA bearing $= EA = S\,0°28'\,W = 180°28'$

also length $= \dfrac{\text{latitude}}{\cos\theta} = 87.85$

Module 3

5 (a)(i) Elevation: the elevation of a point is its Vertical distance above or below the Datum.

Q.No.	Solution and Scheme	Marks

5 (a)(ii) **Bench Mark :** It is reference point whose elevation with respect to some assumed datum is known.

(iii) **Datum :** Datum is any surface to which elevation are referred.

(iv) **Mean Sea level :** It is a average height of the sea for all stages of the tides. (04)

(b)

false LOS
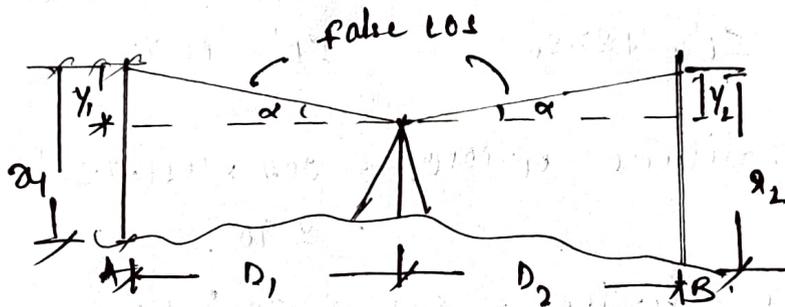
when the diff in elevation between 2 point is determined from single setup by taking BS & FS the error due to non-parallelism is titted to be balanced.

Elimination of Error : from above figure it is clear that when bubble is @ centre & reading were taken by backsight & foresight, line is inclined by angle of α. both staff placed @ equi distance. let observed reading be z_1 & z_2

corrected back sight is equal to $(z_1 - y_1)$ & similarly

corrected fore sight is $(z_2 - y_2)$ where $y_1 = D_1 \tan \alpha$

$y_2 = D_2 \tan \alpha$ (06)

Hence difference in level between A & B.

$= (z_1 - y_1) - (z_2 - y_2) = (z_1 - z_2) + (y_2 - y_1)$ ....

$= (z_1 - z_2) + (D_2 \tan \alpha_2 - D_1 \tan \alpha)$ if $D_1 = D_2$,

thy $(z_1 - z_2) =$ difference.

5 (c)

St No	BS	IS	FS	HI	RL	Remark
1	4.00			199.50	195.50	
2		3.565			195.935	
3	2.15		3.995	197.655	195.505	
4		2.415		~~HI~~	195.24	BM
5		1.665			195.99	
6		-3.115			200.77	
7	3.61		2.565	198.70	195.09	
8			1.715		196.985	
9						

6 (a) **Curvature & Refraction :**

from diagram it is clear that really reading should be @ B but since level provide only horizontal line, reading is taken @ C. so due to curvature of earth we are getting error.
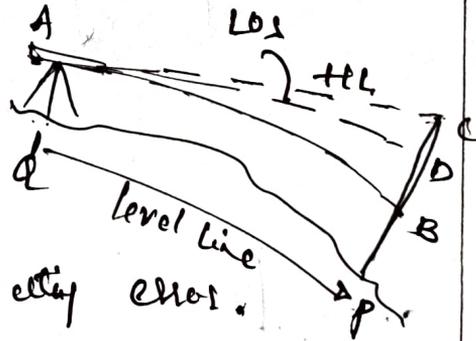
why a LOS travels longer distance the LOS may not be horizontal due to atmosphere. so LOS may be downward. so error is due to refraction.

6 (ii) <u>Barometric levelling</u> : works on the principle that difference in elevation bet 2 points is proportional to the difference in atmospheric pressure at there points.

<u>fly levelling</u> : It is a determination of the difference in elevation of 2 points of the horizontal position of points w.r.t eary other. when distance is apart it may be necessary to set up instrument several times any levelling is called fly levelling. (02)

6 (iii) <u>Collimation error</u> : It is error that is observed along certain Curvature & refraction where line of sight appear lower than what it is.

<u>Hypsometry</u> : It is a instrument used to measure the boiling temperature of water which varies with atmospheric pressure. means mainly used to determine the altitude of stations depending on atmospheric pressure. (02)

6 (b)
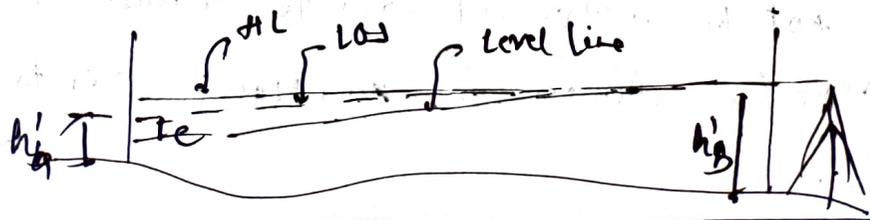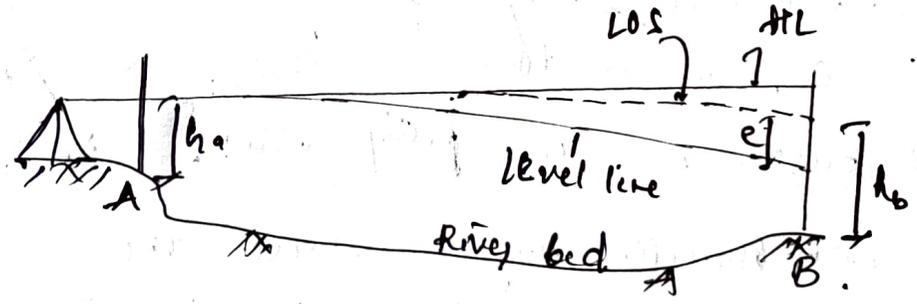
This survey is usually carried under levelling is done across river, where level can be carried in between points and long sight will be taken. as per diagram shown. whey instrument was at A reading @ A is h_a & stff reading @ B is h_b. actually LOS should be horizontal line, Due to Curvature & refraction LOS is @ dotted line so error is e.

true leveling difference
whey instrument @ A .... $H = h_a - (h_b - e)$

lly whey instrument
was @ B. .... $H = (h_a' - e) - h_b'$

∴ $2H = h_a - h_b + e + h_a' - e - h_b'$

$$\boxed{H = \frac{1}{2}(h_a - h_b) + (h_a' - h_b')}$$ ⊙6

⑥C) Given Data   D = 1000m.   RL @ A = 100.150 m

whey instrument @ A

True lvl diff = 2.545 - 1.625 = 0.92 m   A -higher

lly ——"—— = 1.405 - 0.725 = 0.68 m.   A higher

Avg lvl difference = 0.8   A is higher

RL @ B := RL @ A - True lvl difference

= 100.15 - 0.8 = 99.25 m   ⊙8

7(a) **Radiation method:**

A ray is drawn from the instrument station toward the pts the distance is measured between the instrument station & that points, & the point is located by plotting to some scale the distance so measured. Evidently the method is more suitable when distance are small.
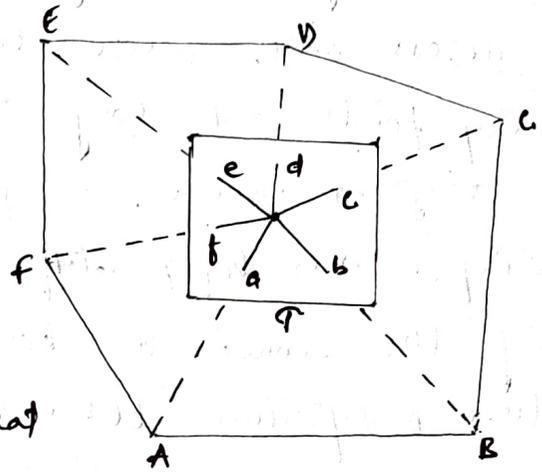
① Set table @ T. level it. Transfer point on sheet. Clamp table.

② keep alidade touching t, sight to A draw a ray they focus @ B, C, D & E draw respective rays

③ measure TA, TB, TC, TD & TE they for suitable Scale draw a, b, c, d join them.

Intersection:

(05)
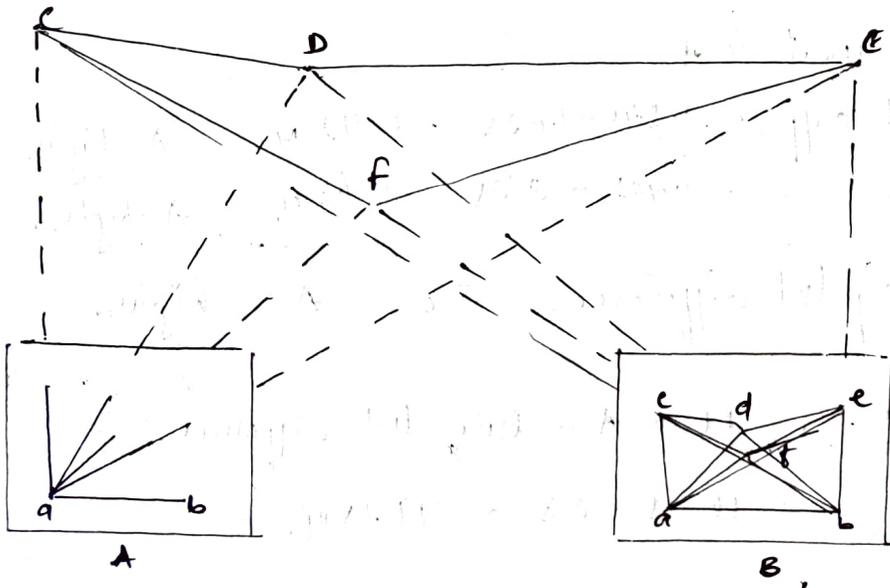
when the distance between 2 points & the instrumentation station is either too larger or cannot be measured accurately due to some field conditions the location of object is determined by sighting at the object from 2 plane table stations & drawing the rays. The intersection of these rays will give the position of the object. It is therefore very essential to have at least 2 instrument stations to locate any point. The line joining the 2 instrument station is called __base line__.   (05)

7 (b)
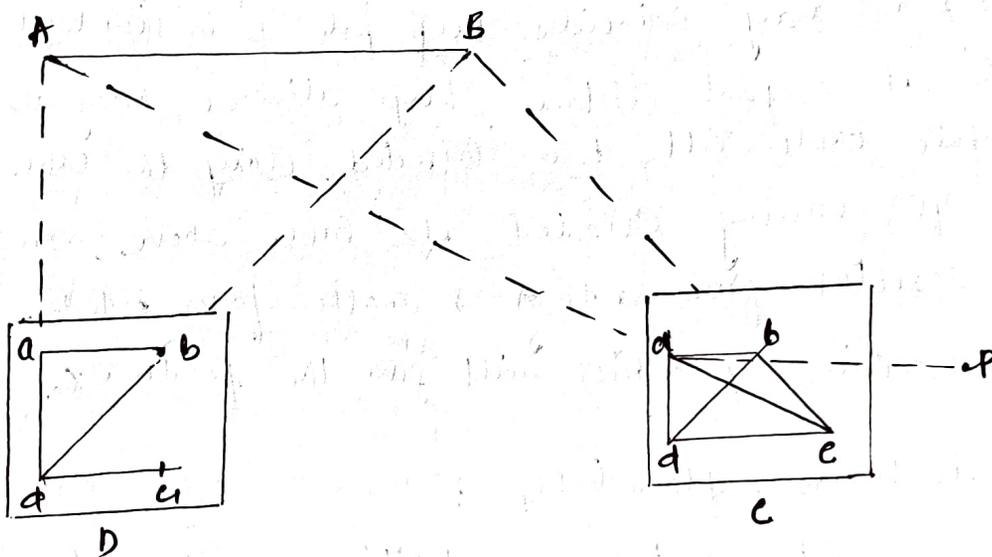
① choose an auxilliary pt D near C, to orientation @ C, set table @ D such way that ab is appear parallel to AB. clamp the table.

② keep alidade @ a & sight A. lay a resector from b to B to intersect previous one is d. then get point d. Transfer to ground & driven a peg.

③ keep alidade @ d & sight C. draw the ray & mark point C₁.

④ Shift table to C. Orient it by taking backsight to D

⑤ keep alidade pivoted at a & sight it to A. Draw the ray to intersect with previously drawn ray from D & C.

⑥ pivoting alidade about c, sight B, draw the ray to intersect with ray drawn from D to B in b'. Then b' is approx. representation of B with respect to Orientation made @ D.

⑦ The angle between ab & ab' is the error in Orientation & must be corrected for. In order to ab & ab' may coincide keep pole B in line with ab' at a great distance. keep alidade along ab rotate table till P is bisected. clamp the table.

⑧ After having Oriented the table above, draw a resector from a to A & another from b to B. intersection of which will give the position C. — ⑩

8 (a) <u>Orientation of plane table :</u>

    It is a process of putting the plane-table into some fixed direction so that line representing a certain direction on the plan is parallel to that direction on the ground. Then it is essential condition to be fulfilled when more than one instrument station is to — ⑪ be used

ii) **Triangle of Error:** It is location of position on the plane of station occupied by the plane table by means of observations of three well defined points whose positions have been previously plotted on th plan. — ②

iii) **Alidade:** there are of 2 types.

&) plain Alidade & Telescopic alidade.

Plane alidade: It generally wooden or metal Rule width 2 vanes @ ends. These vane are hinged @ ends to fold on Rule when not in Use. One of Vane provided with narrow slit and other with hair. Both slits thus provide a definite line of sight. — ②
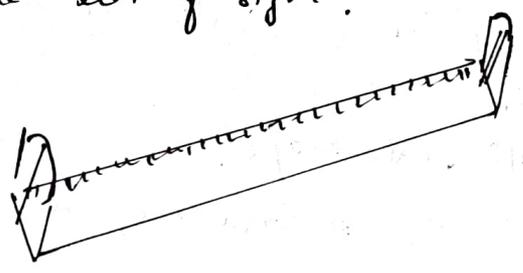
8(6) **Temporary adjustment of plane Table,**

ⓐ **fixing:** fixing the table on tripod.

ⓑ) **Setting:** levelling, placing the spirit lvl on the table in two position @ right angles & getting bubble @ centre in both direction.

Centring: this process is done by plumbing fork table need to be placed Over the station on ground & pt is transfer to sheet by pluning fork

Orientation : This is the process of putting the plane Table into some fixed direction so that line represents a certain direction on the plan is parallel to that direction on the ground.

sighting the points : The points to be sighted betten are sighted through alidade. A ray is drawn from the instrument station along the edge of alidade.

08

8(c) Advantages & disadvantage of plane Tabling.
Advantages.

i) Since plan drawn by surveyor no possibility of omitting measurements.

ii) Since area is to view, contours & irregular objects may be represented accurately.

iii) very useful in magnetic area where compass may not be used.

iv) Suitable for small scale maps.

v) No great skill required to work may be divided among sub ordinate.

disadvantage :

i) Becomes difficult to reproduce map in different scale

ii) for large map may not be accurate.

iii) due to heavyness, it is inconvenient to transport.

iv) difficult in hilly areas

v) inconvenient in rainy season & wet climate.

08

| SL No	Solcetion & Scheme	Marks

Module 5.

9 ⓐ **Contours:** It is a Imiginary line on the ground joining the points of equal elevation.

Uses of Contour line:

① **calculation of reservior capacity:**

Joining the contour lines form a contour map and are required to calculate capacity of reservior elevation of 100, 90, 80 the area enclosed may be measured by a planimeter. the volume of water between 100 to 90 m contour will be equal to the average areas of 2 contours multiplied by contour enterval. similarly volume between other contours Total Volume they will be added. (fig (ii)

② **Drawing of contour gradients & location of Route.**

these contour lines are very much useful in locating the route of highway, railway, canal or any other communication line.

iii) used to calculate sections @ every change.

Mainly used to calculate the earthwork creavation or filling quantity in load way or canal works. (fig i)

08
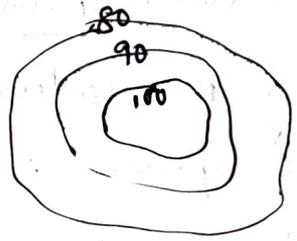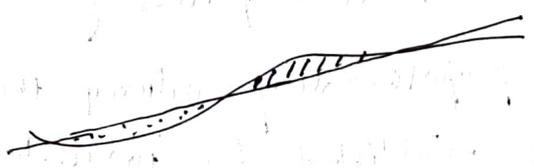
Distance	RL	FL	Depth	Area	
0	120·8	123·00	2·2	33·88	—A1
80	122·50	123·80	1·30	17·68	—A2
160	123·4	124·60	1·20	16·08	—A3
240	123·8	125·40	1·6	22·72	—A4
320	124·50	126·20	1·70	24·48	—A5

Volume Trapezoidal Rule :

$$V = d \left[\frac{A_1 + A_n}{2} + A_2 + A_3 + A_4 \right]$$

$$V = 80 \left[\frac{33·88 + 24·48}{2} + 17·68 + 16·08 + 22·72 \right]$$

$$V = 6852·8 \ cum$$

Prismoidal Rule :

$$V = \frac{d}{3} \left[(A_1 + A_5) + 4(A_1 + A_4) + 2(A_3) \right]$$

$$V = \frac{80}{3} \left[(33·88 + 24·48) + 4(17·68 + 22·72) + 2 \times 16·08 \right]$$

$$= 6723·2 \ cum$$

— (12)

10 (a) (i) **Contour Interval :**

The vertical distance between any 2 consecutive contour is called contour interval.

(ii) **Interpolation of contour :** It is a process of spacing the contours proportinately between the plotted ground points established by indirect method.

Qno	Solutions & Scheme	Marks

10 ⓐ iii) Horizontal equivalent :

the horizontal equivalent between 2 points on two consecutive contours is known as horizontal equivalent.

iv) contour gradient :

It is a line laying throughout on the surface of the ground and preserving a constant inclination to the horizontal.

— ④④

10 ⓑ Planimeter : It is an instrument which measures the area of plan of any shape very accurately.

Polar Planimeter :
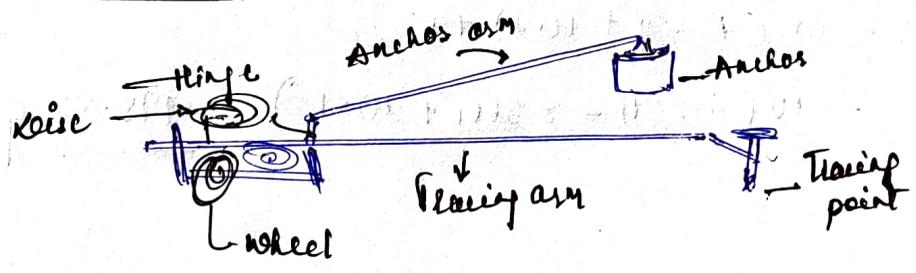
It consist of 2 arms hinged at a point known as pivot pt. One of 2 arms carries an anchor @ its end called anchor arm. Its length is generally fixed. The tracing point is moved along the boundary of the plan, area of which to be determin. the displacement of tracing arm is measured by mean of wheel whose axic is kept parallel to tracing arm. the wheel carries a concentric drum which is divided into 100 divisions. The complete revolutions of wheel are read on the acread by suitable gearing to the wheel.

to find area of plan. the anchor pt is either placed outside the area. or inside the area. The final of plan. anchor pt is either placed outside. the final reading of drum is taken the area of figure is then calculated by

$$A = M(f - 2 \pm 10N + c)$$

<div align="right">(2)</div>

10 ⓒ. Given Data : Initial reading = 8.364 = 8

And — u : 4.234 = f

c = Since anchor pt is Outside = 0.

$N = +1$. & $M = 100$ Sp.cm.

$$A = M(f - 8 \pm 10N + c).$$

$$= 10(4.234 - 8.364 + 10 \times 1) = 995.87 \text{ Sp.cm.}$$

<div align="right">(4)</div>