



**WINTER-14 EXAMINATION**

**Subject code: 17310**

**Model Answer**

Page No:1/16

**Important Instructions to examiners:**

- 1) The answer should be examined by keywords and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language error such as grammatical, spelling errors should not be given more importance.(Not applicable for subject English and communication skill).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figure drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In the some cases, the assumed constants values may vary and there may be some difference in the candidates answer and model answer.
- 6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidates understanding.


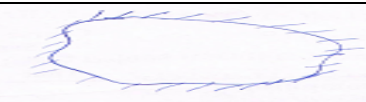


<b>Q1) a) Attempt any <u>SIX</u> of the following</b>			<b>12</b>
<b>i) State the principles of survey.</b>			
<b>Ans. :-</b> Following are the principles:-			
i) To work from the whole to the part.			<b>01</b>
ii) To fix the position of new station by to independent process (i.e. the process may be both linear, both angular, one linear and one angular.			<b>01</b>
<b>ii) State the two uses of survey based on geodetic surveying</b>			
<b>Ans.:-</b> Two uses of survey based on geodetic surveying:-			
i) To determine the precise positions on the surface of the earth.			<b>01 mark each (any two)</b>
ii) Preparation of maps of large area like map of a country, state, etc.			
iii) Establishment of GTS bench Marks across the country.			
iv) Preparation of military maps for defense purposes.			
<b>iii) Give any four codes of signals use to direct assistant in ranging.</b>			
<b>Sr. No</b>	<b>Signal</b>	<b>Meaning</b>	<b><math>\frac{1}{2}</math> mark each ( Any Four  )</b>
1	Rapid sweeps with right Hand	Move considerably to the right	
2	Rapid sweeps with Left Hand	Move considerably to the Left	
3	Slow Sweep with right Hand	Move slowly to the right	
4	Slow sweeps with Left Hand	Move slowly to the Left	
5	Right arm extended	Continue to move to the right	
6	Left arm extended	Continue to move to the Left	
7	Right arm Up and moved to the right	Plumb the road to the right	
8	Left arm Up and moved to the Left	Plumb the road to the Left	
9	Both hands above Head and then Brought Down	Correct	
10	Both Arms extended forward horizontally and the hands depressed briskly	Fix	



ii) Draw conventional symbols for the following :

- a) Pucca building    b) Lake    c) Embankment    d) Church.

Ans:-

a) Pucca building :-	b) Lake:-
	
c) Embankment :-	d) Church.:-
	

**01  
mark  
each**

iii) The down hill end of the 30m taps is held 80cm too low ,what is horizontal length?

Ans:-

Correction for slope =  $h^2/2l$

Here,  $h=0.8\text{m}$  ,  $L= 30\text{m}$

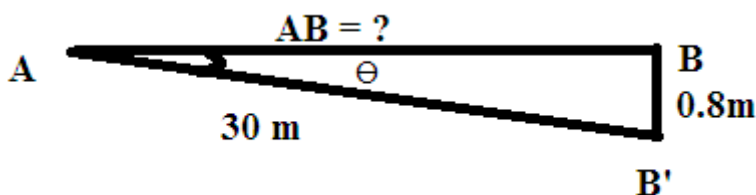
The required correction =  $0.8^2/2 \times 30 = 0.0167 \text{ m}$

Hence the horizontal length =  $30 - 0.0167$

= **29.9833m**

Or

By trigonometric relation



$\sin \theta = \text{Opposite side} / \text{Hypotenuses}$

$\sin \theta = 0.80/30 = 1.528^0$

The horizontal distance =  $L \cos \theta = 30 \cos 1.528$

= **29.98 m**

**02**

**02**

**01**

**02**

**01**

**Q.2 Attempt any four of the following**

**16**

a) Explain Indirect ranging with neat sketch.

Step wise procedure indirect ranging i.e. reciprocal ranging-

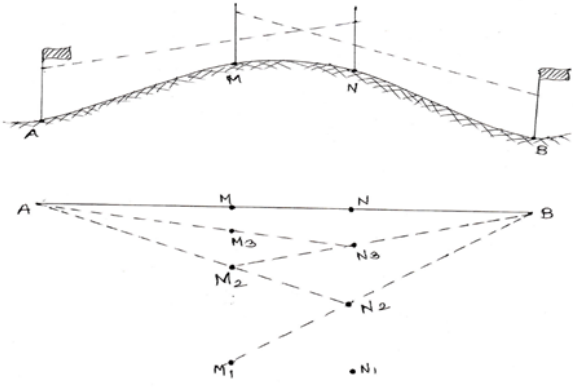
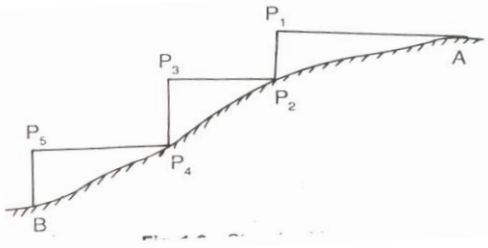
Let A and B be the two station with rising ground or a hill intervening between them even

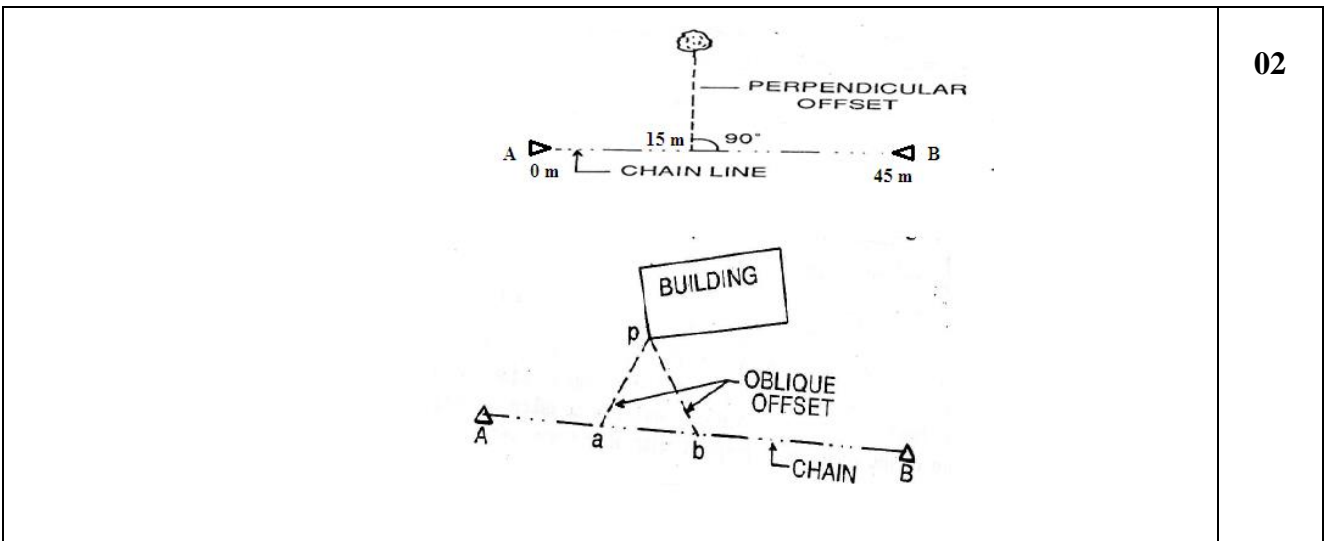
i) Select any two intermediate station say M1 and N1 , between A and B with ranging rods such that from M1 points N1 and B are visible and from N1 , points M1 and A are visible ( as shown in fig.)

ii) Chainman at M1 direct the chainman at N1 to in line with M1 B point ie position at N2 then chainman at N2 directs the chainman at M1 two in line with N2 to A ie position at M2 iii) In the next step Chainman at M2 direct the chainman at N2 to move in line with M2 B ie position at N3.

iv) Thus by successively directing each other into line there position will be changed until finally they are both on the line A B exactly.

**03**

	<b>01</b>
<p><b>b) Explain the method of chaining on sloping ground.</b></p>	
<p>Ans.: 1) Method Of stepping(direct Method)</p> <p>Suppose the horizontal distance between points A and B as shown in fig. is to be measured. The line AB is first ranged properly. Then the follower holds the zero end of the tape at A. The Leader selects a suitable length AP<sub>1</sub> so that P<sub>1</sub> is at chest height and AP<sub>1</sub> is just horizontal. The horizontality is maintained by eye estimation, by tri-square or by wooden set square. The point P<sub>2</sub> is marked on the ground by plumb bob so that P<sub>1</sub> is just over P<sub>2</sub>. The horizontal length AP<sub>1</sub> is noted. Then the follower moves to the position P<sub>2</sub> and hold the zero end of the tape at that point. Again the leader selects a suitable length P<sub>2</sub>P<sub>3</sub> in such way that P<sub>2</sub>P<sub>3</sub> is horizontal and P<sub>3</sub>P<sub>4</sub> is Vertical. Then the horizontal lengths P<sub>2</sub>P<sub>3</sub> and P<sub>4</sub>P<sub>5</sub> are Measured.</p> <p>So the total Horizontal Length AB= AP<sub>1</sub> + P<sub>2</sub>P<sub>3</sub> + P<sub>4</sub>P<sub>5</sub></p> 	
<p><b>c) Length of a survey line measured with a 30 meter chain was found to be 1000meter .At the end of survey ,the chain was compared with a standard chain ,it was found to be 0.15 meter too long .Find correct length of the line .</b></p>	
<p>Ans:-  Data Given:L = 30m,M.L.of line =1000 m, Error = e= 0.15m too long,True length of line =?  Incorrect length of chain = L' = (30 + 30.15)/2  = 30.075 m</p> <p>True length Of line  = (Incorrect length of chain/Correct length of chain) X Measured length of line  T.L.= (L'/L) X M.L.  = (30.075/30) X 1000  T.L. = 1002.5 m</p>	
<p><b>d) What are offsets? How are they taken and recorded? Explain with sketch.</b></p>	
<p>Offsets are lateral measurement to the base line.  They are Located by judgment if short And by instruments (optical square or cross staff) if long and measured by metallic tape and shown with their chainages on base line</p>	



02

e) What consideration would you have while selecting survey stations and survey lines in a chain survey?

**Ans:-** Following points to be considered while selecting survey stations and survey lines

- 1) Main survey station should be mutually visible.
- 2) All triangles should be well conditioned.
- 3) The survey line should lie over the leveled ground.
- 4) The no of survey line should be as few as practicable.
- 5) Each triangle should be provided at least one check line.
- 6) The principle of survey i.e. To work from whole to the part should be strictly observed.
- 7) Base line should run through the center of the area so as to form the frame work of triangles on it to cover maximum area.

1  
mark  
each  
(Any  
four)

f) Describe with neat sketch, the optical square and explain its principle.

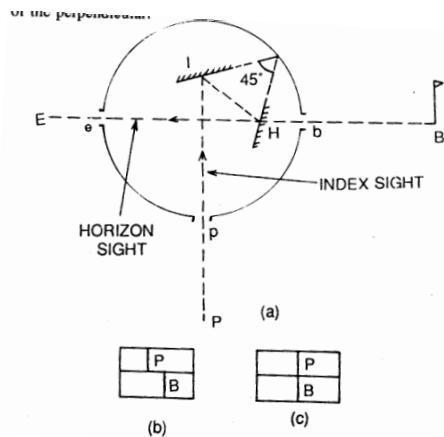
**Principal of optical square :-** the angle between the first incident ray and the last reflected ray is twice the angle between the two mirrors

**OR**

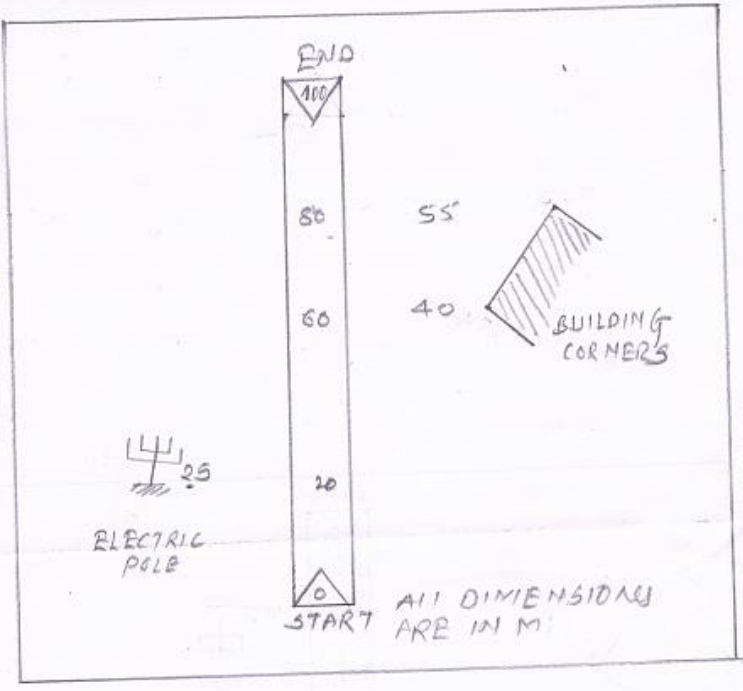
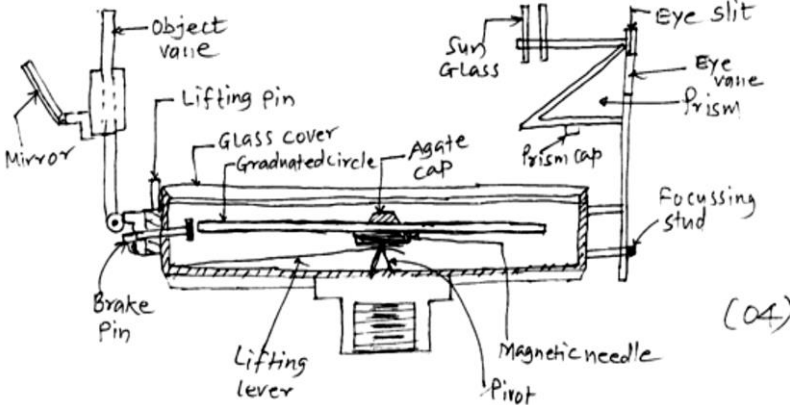
If there are two plane mirrors whose reflecting surfaces make a given angle with each other and if a ray of light in plane perpendiculars to the plains of both mirrors is reflected successively from both, it undergoes a deviation of twice the angle between the reflecting surfaces.

In the case of optical square the angle between the mirrors is  $45^{\circ}$  while that between the first incident ray and last reflected ray is  $90^{\circ}$ .

02



02

<p><b>Q.3 Attempt any four of the following</b></p>	<p><b>16</b></p>
<p>a) Prepare a page of field showing the chain line with following details          i) Length of base line 100m.          ii) A electric pole 25 m perpendicular from chainage 20m at left.          iii) The corners of building are 40m and 55 m from chainage 60 m and 80 m to the right of chain.</p>	
<p>Ans:-</p> 	<p>01 02 01</p>
<p>b) Convert following bearing from R.B to W.C.B.          i) N 40° 30' W, ii) S 49° 30' E, iii) S 43° 30' W, iv) N 45° 00' E</p>	
<p>i) W.C.B. = <math>360^\circ - 40^\circ 30' = 319^\circ 30'</math> R.B. = <math>30^\circ 30'</math></p>	<p>01</p>
<p>ii) W.C.B. = <math>180^\circ - 49^\circ 30' = 130^\circ 30'</math></p>	<p>01</p>
<p>iii) W.C.B. = <math>180^\circ + 43^\circ 30' = 223^\circ 30'</math></p>	<p>01</p>
<p>iii) W.C.B. = R.B. = <math>45^\circ 30'</math></p>	<p>01</p>
<p>c) Draw a neat sketch of Prismatic compass and label its component.</p>	
<p>Ans:-</p>  <p>c/s of Prismatic Compass.</p> <p>*( Fig. 2 mark labeling 2mark)</p>	<p>*</p>

d) Calculate back bearing for following bearing :

i) AB – N 48° E , ii) EF - 270° 30', iii) CD –S 58° 30' W , iv) GH - 180°

Ans:-

Back Bearing = Fore Bearing ± 180°

i) Back Bearing = S 48° W

ii) Back Bearing = 270° 30' - 180° = 90° 30'

iii) Back Bearing = N 58° 30' E

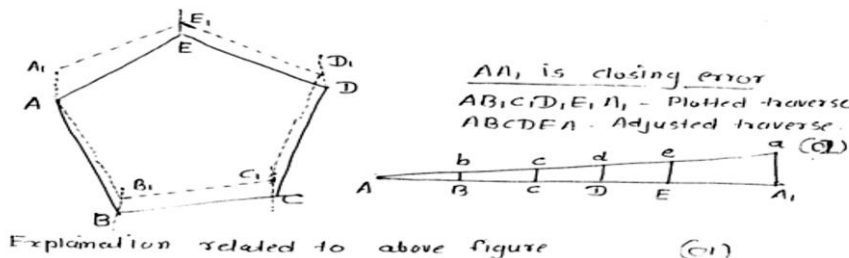
iv) Back Bearing = 0°

01  
01  
01  
01

e) What is meant by closing error? Explain graphical method of adjustment of closing errors.

Ans:-

**Closing error:** The distance by which the traverse fails to close is called closing error.



01  
01

Step 1) Draw a horizontal line AA<sub>1</sub> Equal to the length of perimeter of the traverse to a suitable scale

- 1) Mark the distances AB, BC, CD, ... Etc on the line as per their lengths
- 2) Draw a perpendicular or (parallel to the direction of closing errors) to the line AA<sub>1</sub> Equal to the closing errors.
- 3) Join 'Aa' as shown in figure.
- 4) Draw perpendiculars B, C, D, E, To join the line 'Aa' at b, c, d, e
- 5) Transfer the ordinates to the respective stations on the traverse parallel to the closing errors
- 6) Join the the new points which gives the closed traversed. A, B, C, D and A.

02

f) Give the differences between closed and open traverse survey

Ans:-

Closed traverse Survey	Open traverse Survey
In closed traversed survey the bearing of first line and included angles are measured.	In open traversed survey bearing of survey lines are measured
Closed traverse survey is suitable for survey of ponds, Buildings etc.	Open traverse survey is suitable for the survey of roads, rivers, coast lines etc.
Check a) Sum of all included angle (2N - 4) x 90 b) Sum of all External angle (2N + 4) x 90	Check :- a) Length of Check line on Map = Length of Check line on Ground b) Bearing of Check line on Map = Bearing of Check line on Ground

1  
1  
1  
1

Q.4 Attempt any FOUR of the following :

16

a) The following bearings observed in a traverse survey conducted with a Prismatic compass at a place where local attraction was suspected. At what station do you suspect local attraction? Find the correct bearings of the line.

Line	FB	BB
AB	44° 30'	226° 30'
BC	124° 15'	303° 15'
CD	181° 00'	1° 00'
DA	289° 30'	108° 45'

Ans:-

The difference of fore bearing and back bearing of only line CD is Exactly  $180^0$  Hence station C & D are free from local attraction.

At station A & B local attraction is suspected

Line	F.B	B.B.	Differ ence	Correction	Corrected		Remark
					F.B	B.B.	
AB	$44^0 30'$	$226^0 30'$	182	$+ 0^0 45'$ At A	$45^0 15'$	$225^0 15'$	station C & D are free from local attraction
BC	$124^0 15'$	$303^0 15'$	179	$- 1^0 15'$ At B	$123^0 15'$	$303^0 15'$	
CD	$181^0 00'$	$1^0 00'$	$180^0$	-----	$181^0 00'$	$1^0 00'$	
DA	$289^0 30'$	$108^0 45'$	$180^0$ 45	-----	$289^0 30'$	$109^0 30'$	

At the line CD, FB. of DC – BB. of CD =  $181^0 00' - 1^0 00' = 180^0$

Therefore C and D are free from local attraction

Corrected FB of DA =  $289^0 30'$

Corrected Back bearing Of DA = Corrected FB of DA -  $180^0$   
 $= 289^0 30' - 180^0 = 109^0 30'$

Correction at A = Corrected Back bearing of DA – Observed Back bearing of DA  
 $= 109^0 30' - 108^0 45' = 0^0 45'$

Corrected FB of AB = Obs. FB of AB + correction at A  
 $= 44^0 30' + 0^0 45' = 45^0 15'$

Corrected BB of AB =  $45^0 15' + 180^0 = 225^0 15'$

Correction at B =  $225^0 15' - 226^0 30' = -1^0 15'$

Corrected FB of BC =  $124^0 30' - 1^0 15' = 123^0 15'$

Corrected BB of BC =  $123^0 15' + 180^0 = 303^0 15' =$  Observed BB of BC

O.K. Check is Verified

*\*( Identification of stations 1 mark, sample calculation 1 mark, Corrected FB And BB 2 mark)*

### b) What are the sources of errors in plane tabling?

Ans:- The following are the sources of errors in plane tabling

- 1)The board not being horizontal
- 2)The table not being accurately centered
- 3)The table not being Correctly oriented
- 4)The objects not being sited accurately
- 5)The alidade not being correctly centered on the station point on the paper
- 6)The rays not being accurately drawn through the station point
- 7)Inaccuracy in plotting
- 8)The expansion and contraction of the paper

*\*(Any Four 1 mark each)*

### c) State advantages and disadvantages of plane table survey

Ans.:- **Advantages :-**

1. It is the most rapid method of surveying.
2. There is no need for a field book as plotting is done along with the field work. So, the problem of mistake in booking field notes does not arise.
3. Plotted work can be compared with actual object regardless of whether or not they are properly represented.
4. There is no possibility of overlooking any important object.
5. There is no possibility of overlooking any measurement as plotting is done in the field.
6. Irregular objects may be represented accurately.
7. It is suitable in magnetic areas.
8. The map can be prepared easily, and does not require any great skill.
9. Errors in measurement and plotting can be detected by check lines.
10. Inaccessible points can be easily located by intersection.

*\*(Any Two 1 mark each)*

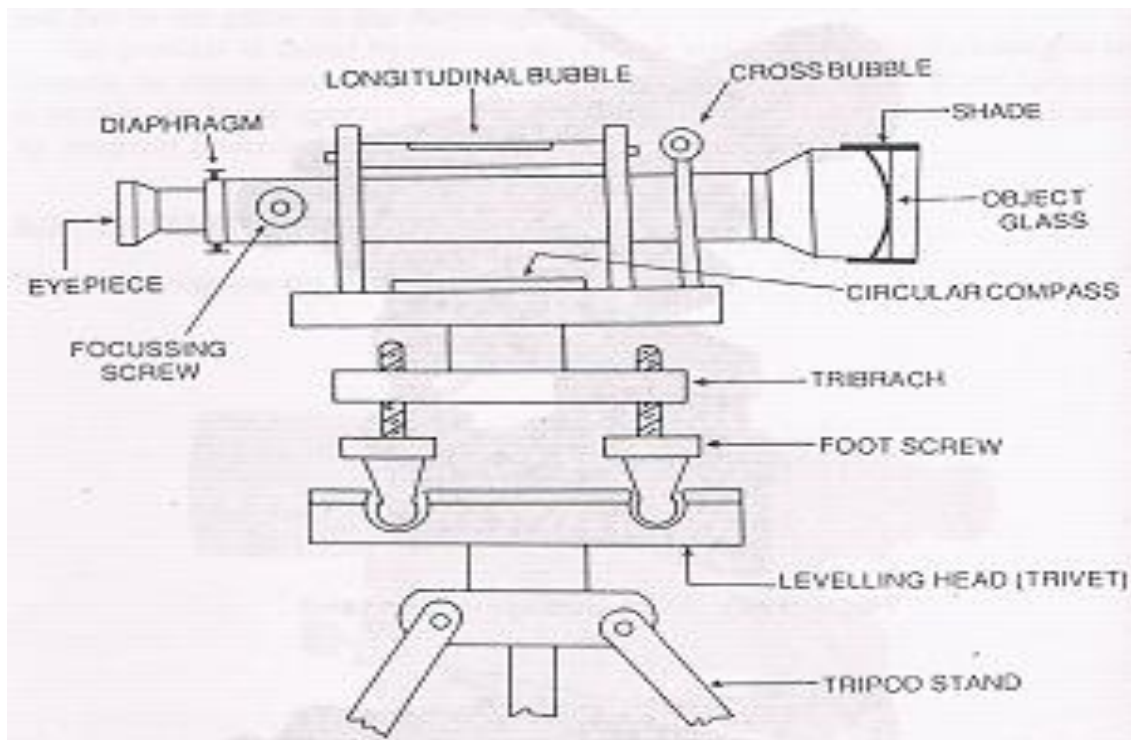


<p><b>Disadvantages :-</b></p> <ol style="list-style-type: none"> <li>1. The plane table is not suitable for accurate work as the fitting arrangement is not perfect.</li> <li>2. Plane table surveying is not suitable in wet climate, in the rainy season, on foggy mornings and in windy weather.</li> <li>3. The number of accessories required in such survey is large, and they are likely to be lost.</li> <li>4. The instrument is very heavy and difficult to carry.</li> <li>5. The map cannot be replotted to a different scale as there is no field book.</li> </ol> <p style="text-align: center;"><i>*(Any Two 1 mark each)</i></p>	*
<p><b>d) State any four accessories of plane table with their uses.</b></p>	
<p><b>Ans:- Following are the accessories of plane table survey</b></p> <ol style="list-style-type: none"> <li><b>i) The plane table:</b> It is used for fixing a drawing sheet over it. To locate the position of the objects on the sheet by drawing rays and plotting to suitable scale.</li> <li><b>ii) The Alidade (plain Alidade, Telescopic Alidade):</b> It is used to sight the objects . To draw rays along the fiducial edge</li> <li><b>iii) The spirit level:</b> It is used for leveling the plane table</li> <li><b>iv) The compass:</b> (Trough Compass, Circular compass): It is used for marking the North direction on the map. To orient the plane table</li> <li><b>v) U-Fork or Plumbing fork with plumb bob:</b> It is used for centering the table over the station.</li> </ol> <p style="text-align: center;"><i>* (Any four 1/2mark for name of accessories and 1/2 for function.)</i></p>	*
<p><b>e) What is meant by orientation of plane table? Explain any one method.</b></p>	
<p><b>Orientation:</b> The orientation of plane table means keeping the plane table at all stations parallel to the position at first station</p> <p><b>Orientation by Magnetic needle : Procedure-</b></p> <ol style="list-style-type: none"> <li>a) Suppose <b>A and B</b> are the two stations. The plane table is set up at station A and leveled by spirit level. The centering is done by U fork and plumb bob so that pint a is just over the station A. Then the trough compass or circular box compass is placed on the right hand top corner of the sheet in such a way that the needle coincides with 0-0 mark. After this, a line representing the north line is drawn through the edge of the compass box. The table is clamped.</li> <li>b) With the alidade touching the point a, the ranging rod at B is bisected and a ray is drawn. The distance AB is measured and plotted to any suitable scale.</li> <li>c) The table is shifted and centered over B, so that point b is just over B. the table is leveled. Now the trough compass is placed exactly along the north line drawn previously. The table is then turn clockwise or anticlockwise until the needle coincides exactly with 0-0 mark of the compass. While turning the table, care should be taken not to disturb the centering. In case it is, it should be adjusted immediately.</li> <li>d) When the centering and leveling are perfect and the needle is exactly at 0-0, the orientation is said to be perfect</li> </ol> <p style="text-align: center;"><b>OR</b></p> <p><b>Orientation by back sighting: Procedure-</b> Ref Fig. bellow</p> <ol style="list-style-type: none"> <li>a) Suppose A and B are two stations. The plane table is set up over A. the table is leveled by spirit level and centered by U-fork so that point 'a' is just over station A. The north line is marked on the right hand top corner of the sheet by trough compass.</li> <li>b) With the alidade touching 'a', the ranging rod at B is bisected and a ray is drawn. The distance AB is measured and plotted to any suitable scale. So the point 'b' represents station B.</li> <li>c) The table is shifted and set up over B. It is leveled and centered so that 'b' just over B. Now the alidade is placed along the line 'ba', and the ranging rod at A is bisected by turning the table clockwise or anticlockwise. When the centering, leveling and bisection of the ranging rod at A are perfect, then the orientation is said to be perfect.</li> </ol>	<p><b>01</b></p> <p><b>03</b></p> <p><b>02</b></p>

	<p><b>01</b></p>
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**f) Draw a neat sketch of dumpy level and name all parts.**

Ans:-



*\*(Sketch 02 marks ,Any four parts labeling 02 marks)*

Q.5 .Attempt any four of the following :

**16**

**a) Define the following :**

**i) Height of instrument**

**ii) Back sight**

**iii) Fore Sight**

**iv) Axis of bubble tube**

- i) **Height of instrument** :The elevation (R.L.) of the plane of collimation with respect to the datum when the instrument is correctly leveled is known as height of instrument
- ii) **Back sight**: The first staff reading taken on a point of known elevation (i.e. B.M. or C.P.) after the level is set up and leveled is known as back sight.
- iii) **Fore sight**: The last staff reading taken on a point denoting the shifting of the instrument whose elevation is to be determined as on change point or end point.
- iv) **Axis of bubble tube**: An imaginary line tangential to longitudinal curve of the bubble tube at its middle point is known as axis of bubble tube.

**01**

**01**

**01**

**01**

<b>b) State the fundamental axes and mention their relationship for a dumpy level.</b>																				
<p><b>Ans:-</b> Fundamental axis of dumpy level are as follows;</p> <ul style="list-style-type: none"> <li>i) The vertical axis</li> <li>ii) The axis of bubble tube</li> <li>iii) The line of collimation</li> <li>iv) The axis of the telescope</li> </ul> <p>Relationship between fundamental axis of dumpy level</p> <ul style="list-style-type: none"> <li>i) The axis of level tube should be perpendicular to the vertical axis</li> <li>ii) The line of collimation should be parallel to the axis of bubble tube</li> <li>iii) Axis of telescope and line of collimation should coincide when dumpy level is correctly leveled.</li> </ul> <p style="text-align: center;"><b>*(Any Two relations)</b></p>		<p><b>02</b></p> <p><b>02*</b></p>																		
<b>c) Differentiate between collimation plane method and rise and fall method</b>																				
<p><b>Ans:</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Sr.No</th> <th style="width: 45%;">Collimation plane method</th> <th style="width: 45%;">Rise and fall method</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>It is more rapid , less tedious</td> <td>It is slow and more tedious.</td> </tr> <tr> <td>2</td> <td>It is simple as it involve less calculation</td> <td>It is laborious as it involves more calculation</td> </tr> <tr> <td>3</td> <td>In this method no check on calculation of R.L. of intermediate sight and mistake made remain unchecked</td> <td>In this method complete check on all calculation work.</td> </tr> <tr> <td>4</td> <td>In this method the error in calculating the R,L, of any point is not carried forward as the R,L, are calculated from the respective plane of collimation</td> <td>In this method the mistake made in calculating the R.L. of any point will be carried forward</td> </tr> <tr> <td>5</td> <td>It is usually used in profile leveling calculation (Road,Railway,canal project)</td> <td>It is used in precise leveling work, check leveling etc., calculations (transfer of B.M. from one point to other)</td> </tr> </tbody> </table> <p style="text-align: center;"><b>*(Any four 1 mark each)</b></p>		Sr.No	Collimation plane method	Rise and fall method	1	It is more rapid , less tedious	It is slow and more tedious.	2	It is simple as it involve less calculation	It is laborious as it involves more calculation	3	In this method no check on calculation of R.L. of intermediate sight and mistake made remain unchecked	In this method complete check on all calculation work.	4	In this method the error in calculating the R,L, of any point is not carried forward as the R,L, are calculated from the respective plane of collimation	In this method the mistake made in calculating the R.L. of any point will be carried forward	5	It is usually used in profile leveling calculation (Road,Railway,canal project)	It is used in precise leveling work, check leveling etc., calculations (transfer of B.M. from one point to other)	*
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<b>d) What are the advantages of auto level?</b>																				
<p>Advantages of auto level are as follows:</p> <ul style="list-style-type: none"> <li>i) It is convenient for large number of staff reading and long distances.</li> <li>ii) It is used when high degree of precision is required.</li> <li>iii) Use of auto level is feeling comfortable. No strain on eyes, nerves and hands of the observer.</li> <li>iv) It is used when high speed leveling work is required.</li> <li>v) It provides automatic leveling and remains in leveled condition for long time because of compensator provided in it .</li> <li>vi) No less influencing of vibration clouds, rain, magnetic fields on leveling work with carried auto level.</li> </ul> <p style="text-align: center;"><b>*(Any four 1 mark each)</b></p>		*																		
<b>e) Explain importance of bench mark in leveling and state types of bench mark.</b>																				
<p>To start with any type of leveling work it must have to start with respect some reference point because all R.L.s of different point are relative RLs. Hence to start any type of leveling work B.M. is important because without that leveling operation cannot be continued i, e.to find H.I.and then R.L. of other points or to find rise and fall then find R.Ls.</p> <p>Types of B.M.:</p> <ul style="list-style-type: none"> <li>i) Great trigonometrically survey (G.T.S ) bench mark</li> <li>ii) Permanent bench mark (P.B.M.)</li> <li>iii) Arbitrary bench mark (A.B.M.)</li> </ul>		<p><b>02</b></p> <p><b>02</b></p>																		

iv) Temporary bench mark (.T.B.M)

f) The following consecutive reading were taken with a dumpy level and 4 m leveling staff on continuously sloping ground A to B at every 30 m interval. 0.355 m on A , 0.730, 1.055, 2.690, 3.950, 0.485, 1.020, 1.895, 2.535. The R.L. of A was 560.250 m Prepare page of level book and checks your calculation by usual method. Determine the gradient of the line AB.

Staff station	Chainage	Staff reading			H.I.	R.L.	Remark
		B.S.	I.S.	F.S.			
1	00	0.355			560.605	560.250	Point A
2	30		0.730			559.875	
3	60		1.055			559.550	
4	90		2.690			557.915	
5	120	0.485		3.950	557.140	556.655	C.P1
6	150		1.020			556.120	
7	180		1.895			555.245	
8	210			2.535		554.605	Point B

$$\text{Arithmetic check} = \sum \text{B.S.} - \sum \text{F.S.} = \text{Last R.L.} - \text{First R.L.}$$

$$0.840 - 6.485 = 554.605 - 560.$$

$$- 5.645 = -5.645$$

O.K. check is verified

Sample calculations :

$$\text{For staff station 01: H.I.} = \text{R.L. of station of station A} + \text{B.S.}$$

$$= 560.250 + 0.355 = 560.605$$

$$\text{For staff station 02: R.L.} = \text{H.I.} - \text{I.S.}$$

$$\text{Gradient of line AB} = \frac{\text{vertical distance between A and B}}{\text{Horizontal distance between A and B}} \times 100$$

$$= \frac{560.605 - 0.730}{210} \times 100 = 2.688\% \text{ downward from A to B}$$

**OR**

Staff station	Chainage	Staff reading			Rise	Fall	R.L.	Remark
		B S.	I.S.	F.S.				
1	00	0.355				560.250	Point A	
2	30		0.730		0.375	559.875		
3	60		1.055		0.325	559.550		
4	90		2.690		1.635	557.915		
5	120	0.485		3.950	1.260	556.655	C.P1	
6	150		1.020		0.535	556.120		
7	180		1.895		0.875	555.245		
8	210			2.535	0.640	554.605	Point B	

$$\text{Arithmetic check} = \sum \text{B.S.} - \sum \text{F.S.} = \sum \text{Rise} - \sum \text{Fall} = \text{Last R.L.} - \text{First R.L.}$$

$$0.840 - 6.485 = 00 - 5.645 = 554.605 - 560.$$

$$- 5.645 = -5.645$$

$$\text{Gradient of line AB} = \frac{\text{vertical distance between A and B}}{\text{Horizontal distance between A and B}} \times 100$$

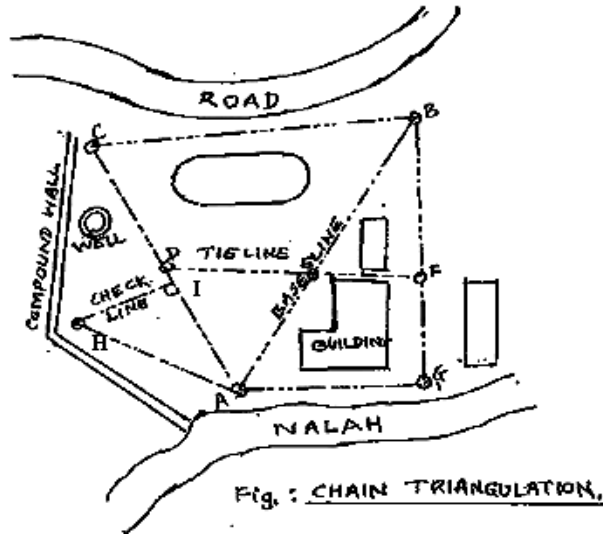
$$= \frac{5.645}{210} \times 100 = 2.688\% \text{ downward from A to B}$$

***\*(Preparation of page of level book /Table 1 mark, Determination of gradient 1 mark ,calculation of RL 2 marks)***

Q.6 attempt **any two** of the following :

- a) 1) Describe with neat sketch.
- i) Base line    ii) check line
- iii) Tie line    iv) Tie station

02



**Description**

**AB :- Base line:** “The line on which the formwork of the survey is built is known as the base line,

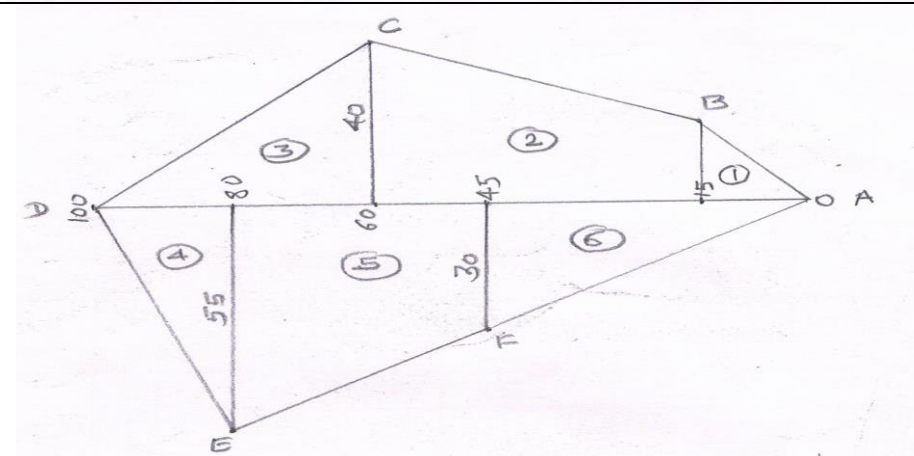
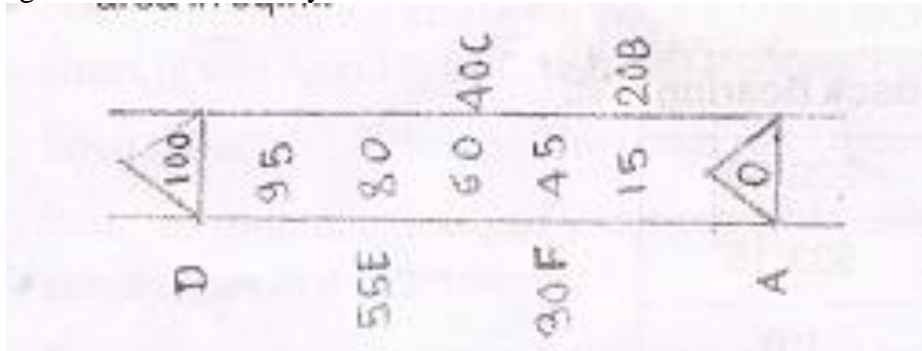
**DE :- Tie Line :** The line joining the tie stations are known as tie line,

**HI -Check Line :** The line joining the apex point of triangle to some fixed point on its base

**Tie Stations :** F,D,-Subsidiary stations taken on the main survey line are known as Tie Stations

02

2) Plot the given cross staff survey of a field ABCDEFA and calculate its area in sq.m



Ans:-

Fig No	Chainage		Base distance	Offset		Mean offset	Area
	from	to		I	II		
1	2	3	4	5	6	7	8
1	0	15	15	0	20	10	150
2	15	60	45	20	40	30	1350
3	60	100	40	40	0	20	800
4	80	100	20	55	0	27.5	550
5	45	80	35	30	55	42.5	1487.5
6	0	45	45	30	0	15	675

Area of field

ABCDEFA = 5012.5 sqm

\*(Table 1 mark, Data Entry 1 marks, Calculation 01 mark)

1

- b) The following bearings have been observed while carrying out a closed compass traverse in clockwise direction.

Line	Observed	
	F.B	B.B
AB	285 <sup>0</sup> 30'	105 <sup>0</sup> 30'
BC	32 <sup>0</sup> 00'	210 <sup>0</sup> 00'
CD	149 <sup>0</sup> 00'	331 <sup>0</sup> 30'
DA	198 <sup>0</sup> 30'	18 <sup>0</sup> 00'

Calculate the error due to local attraction and find corrected bearing and also compute the included angles.

Ans:-

**Step 1:** Find the difference between F.B, And B.B. Of a line and determine the Station free from Local Attraction.

Line	Observed		Difference	Correction	Corrected		Corrected Included angle
	F.B	B.B			FB	BB	
AB	285 <sup>0</sup> 30'	105 <sup>0</sup> 30'	180 <sup>0</sup> 0'	-	285 <sup>0</sup> 30'	105 <sup>0</sup> 30'	92 <sup>0</sup> 30'
BC	32 <sup>0</sup> 00'	210 <sup>0</sup> 00'	178 <sup>0</sup> 0'	-	32 <sup>0</sup> 00'	212 <sup>0</sup> 00'	73 <sup>0</sup> 30'
CD	149 <sup>0</sup> 00'	331 <sup>0</sup> 30'	182 <sup>0</sup> 0'	At c 2'	151 <sup>0</sup> 00'	331 <sup>0</sup> 00'	61 <sup>0</sup> 00'
DA	198 <sup>0</sup> 30'	18 <sup>0</sup> 00'	180 <sup>0</sup> 30'	At d 30'	198 <sup>0</sup> 00'	180 <sup>0</sup> 30'	133 <sup>0</sup> 00'

\*

**Step 2:** Hence the Difference between F.B. Of line = 180<sup>0</sup>, there fore stations A and B are free from Local Attraction and bearings observed at A and B are already correct

Start from:

$$\text{F.B. of BC} = 32^{\circ}00'$$

$$\text{To find BB of BC} = +180^{\circ}00' = 212^{\circ}00'$$

$$\text{To find correction at c station} = -210^{\circ}00'$$

$$\text{Correction at stations C} = +2^{\circ}00'$$

$$\text{To find correct FB of CD} = +149^{\circ}00'$$

$$\text{Correct FB of CD} = 151^{\circ}00'$$

$$\text{To find BB Of CD} = +180^{\circ}00'$$

$$\text{Correct BB of CD} = 331^{\circ}00'$$

$$\text{To find correction at station D} = -331^{\circ}30'$$

$$\text{Correction at station D} = -0^{\circ}30'$$

$$\text{To find correct FB of DA} = +198^{\circ}30'$$

$$\text{Correct FB of DA} = 198^{\circ}00'$$

$$\text{To find correct BB of DA} = -180^{\circ}00'$$

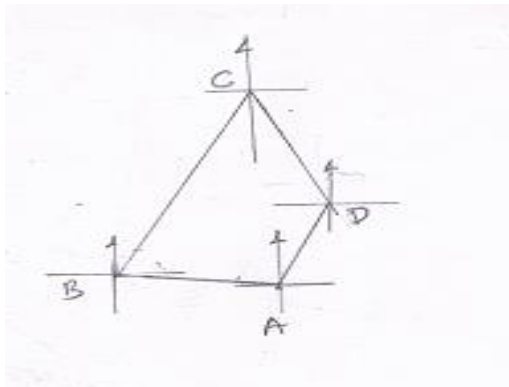
Correction BB of DA =  $18^{\circ}0'$   
 = observed BB of DA

Sample calculation Included angles o.k. check is verified

Included angles = B.B of preceding line FB of next line i.e.

$\angle A = (\text{BB OF DA} - \text{FB of AB})$   
 $= 18^{\circ} - 285^{\circ}30'$   
 $= +267^{\circ}30' > 180$   
 $\angle A = 92^{\circ}30' (360^{\circ} - 267^{\circ}30')$   
 $\angle B = 105^{\circ}30' - 32^{\circ}00' = 73^{\circ}30'$   
 $\angle C = 212^{\circ}00' - 151^{\circ}00' = 61^{\circ}00'$   
 $\angle D = 331^{\circ}00' - 198^{\circ}00' = 133^{\circ}00'$   
 $(2n-4) \times 90 = 360^{\circ}00'$

Similarly



**\*(Identification of stations 2 mark. Calculation of correction 2 marks, calculation of corrected bearing 02 mark, Calculation of included angle 02 mark)**

c) The series of staff reading observed on a continuously sloping ground are 0.850, 1.650, 2.540, 3.255, 0.655, 1.250, 1.955, 2.650, 3.250, 1.150, 1.655, 2.055 And 3.255. The first reading was taken on a B.M. Of R.L. 150.000 Calculation the R.L of all points by collimation plane method. Apply usual checks. Show tabulation

Ans:-

Staff station	Staff Reading			H.I	R.L	Remark
	BS	IS	FS			
1	0.850			150.850	150.000	First Reading B.M
2		1.65.0			149.200	
3		2.450			148.400	
4	0.6555		3.255	148-250	147.595	CPI
5		1.250			147.000	
6		1.955			146.295	
7		2.650			145.600	
8	1.150		3.250	146.150	145.000	CPZ
9		1.655			144.495	
10		2.055			144.095	
11			3.255		142.895	Last reading

**Ans:-Arithmetic check**

$\sum BS - \sum FS = \text{Last RL} - \text{first RL}$   
 $2.655 - 9.76 = 142.895 - 150.000$   
 $-7.105 = -7.105$

Ok check is verified

**Sample calculation**

H.I-RL of BM (or RL of CP)+BS  
 RL of any point =H.I-(IS or FS)

\*

H.I-first set , $150.000+0.850=150.850$ C.P.(1) second set $147.595+0.655=148.250$ C.P.(2) Third set $145.595+1.150=146.250$ RL of point 4= $150.850-3.255=147.595\text{m}$ And so on....	
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**\*(Table 01 mark. Data entry 02 mark Sample calculation 01 mark, Calculation of RL02 marks, Check 02 marks, )**