

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/
MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2017**

SURVEYING - I

[Time : 3 hours

(Maximum marks : 100)

PART — A

(Maximum marks : 10)

Marks

I Answer *all* questions in one or two sentences. Each question carries 2 marks.

1. Differentiate between Plane surveying and Geodetic surveying.
2. What are the temporary adjustments to be done while setting plane table over a station point ?
3. What is Isogonic lines ?
4. Differentiate between fore sight and back sight in levelling.
5. Name the vertical distance between any two consecutive contours.

(5 × 2 = 10)

PART — B

(Maximum marks : 30)

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

1. Explain the procedure for chaining along a sloping ground.
2. What are the points to be considered while selecting survey stations ?
3. What is ranging and explain the different types of ranging ?
4. Find the back bearing of the given lines from the following fore bearings.

<i>Line</i>	<i>Magnetic bearing</i>
PQ	56°21'
QS	S28°45'E
BC	S30°50'W

5. Differentiate between profile levelling and cross sectioning.
6. Differentiate between Countour and Countour Interval.
7. Define reciprocal levelling and explain the procedure for reciprocal levelling.

(5 × 6 = 30)

PART — C

(Maximum marks : 60)

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

UNIT — I

- III (a) What are the primary classifications of surveying ? 7
- (b) Explain the method of Intersection in Plane Table Surveying. 8

OR

- IV (a) The distance between two points measured with a 30m chain was recorded as 648m. Afterwards found that the chain was 60mm short. Find the distance between the points. 7
- (b) What is local attraction and explain briefly. How this can be detected and eliminated ? 8

UNIT — II

- V Below are the bearings observed in traversing with a compass. Compute the interior angles. Also apply the check.

<i>Line</i>	<i>Forebearing</i>
AB	60°30'
BC	122°0'
CD	46°0'
DE	205°30'
EA	300°0'

15

OR

- VI (a) Differentiate between Prismatic compass and Surveyors compass. 7
- (b) Explain the advantages and disadvantages of Plane Table Surveying. 8

UNIT — III

- VII (a) Explain the temporary adjustments of a level. 7
- (b) Explain the methods of booking and reducing the elevation of points from the observed staff readings. And also compare the two methods. 8

OR

- VIII It required to ascertain the elevation of two points P and Q and a line of levels was run from P to Q. The levelling then continued to a benchmark of 83.500. The readings obtained as shown below. Obtain the R.L. of P and Q.

<i>B.S</i>	<i>IS</i>	<i>F.S</i>	<i>R.L</i>	<i>Remarks</i>
1.622				P
1.874		0.354		
2.032		1.780		
	2.362			Q
0.984		1.122		
1.906		2.824		
		2.036	83.500	B.M

15

UNIT — IV

- IX (a) What are the characteristics of contours ? 7
 (b) Explain about the different types of errors in levelling. 8

OR

- X The following observations were made in a reciprocal levelling.

<i>Inst at</i>	<i>Staff readings on</i>		<i>Remarks</i>
	P	Q	
			Distance between P and Q = 1010m
P	1.824	2.748	R of P = 126.386
Q	0.928	1.606	

Find (i) the RL of Q.

(ii) The Combined correction for curvature and refraction.

15

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SKT. 2.

SURVEYING. I.

PART. A.

I.

1. Plane Surveying:- In which the mean surface of earth is considered as plane and spheroidal shape is neglected.

Geodetic Surveying:- In which the shape of earth is taken in to account.

2) Three operations are needed.

(a) Fixing (b) Setting - (i) Levelling the table.
(ii) Centring.
(iii) orientation

(c) Sighting the points.

3) Isogonic line is the line drawn through through the points of same declination.

4) Back sight (B.S):- Back sight is the sight taken on a rod held at a point of known elevation and to obtain the height of instrument or height of plane of sight.

Fore Sight:- Fore Sight is a sight taken on a rod held at a point of unknown elevation and to ascertain the amount by which the point below the line of sight and thus to obtain the elevation of the station.

5. Contour Interval.

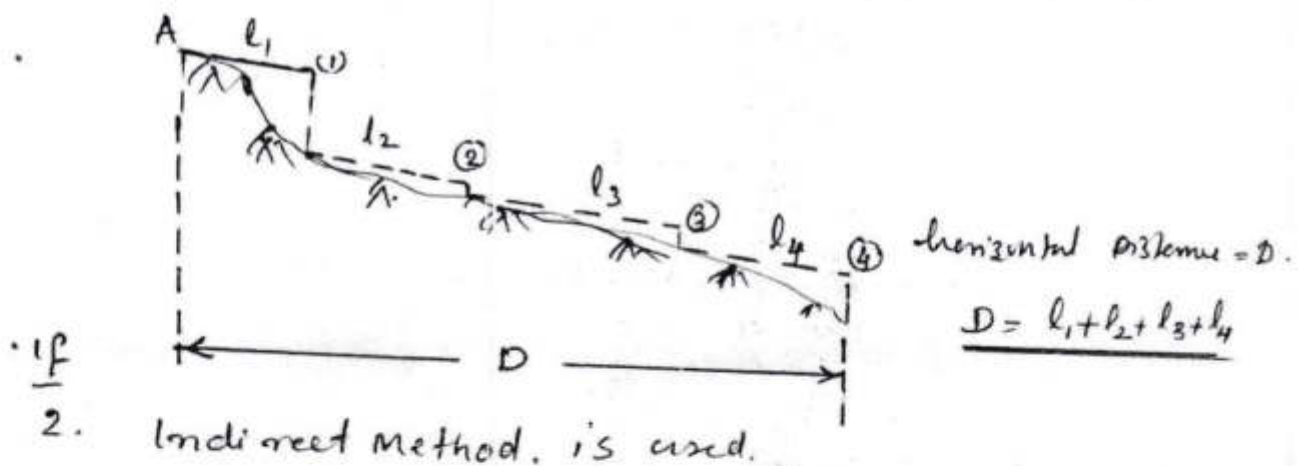
II.

PART B.

D. chaining on sloping ground:- Two method.

1. Direct Method.
2. Indirect method.

(m) Direct method / method of stepping - The distance is measured in small horizontal stretches.



if

2. Indirect method is used.

Method. 1. Angle measured. Method. 2. Difference in level measured method. 3. Hypotenusal allowance.

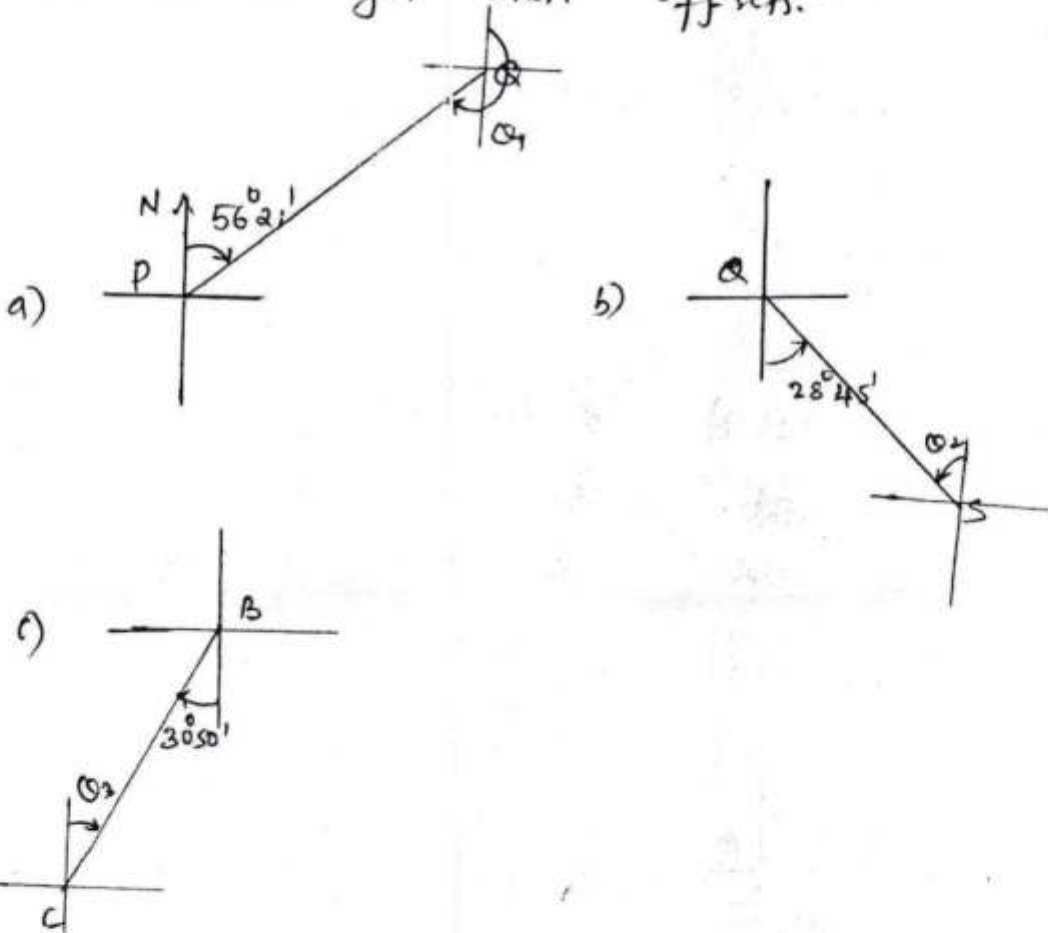
2)

- 1) Survey Stations must be mutually visible.
- 2) Survey Lines should be as few as possible
- 3) The frame work must have one or two base lines.

(3)

- 4) The lines should run through level ground as possible.
- 5) The main lines should be well conditioned triangle.
- 6) As far as possible main survey lines should not pass through obstacles.
7. All lines from which offsets are taken should be placed close to corresponding surface features so as to get short offsets.

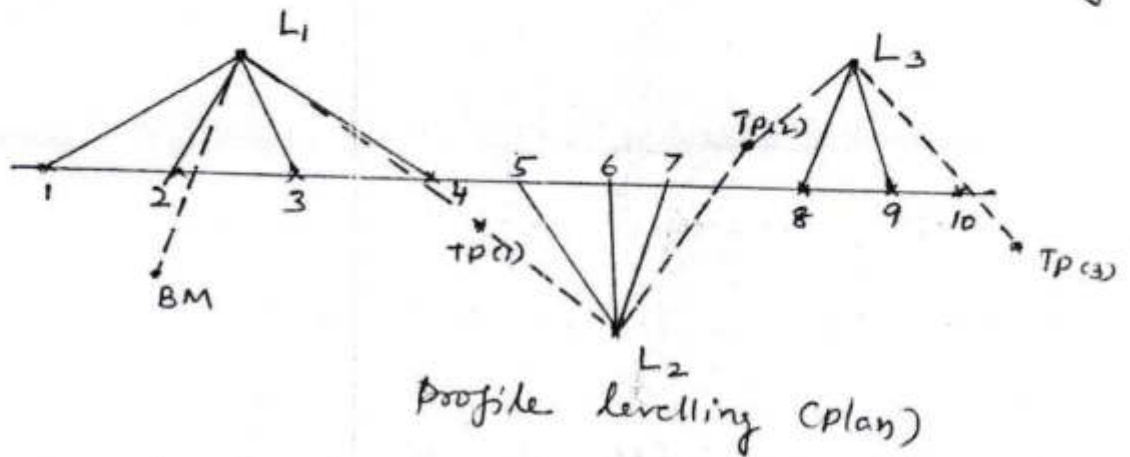
4).



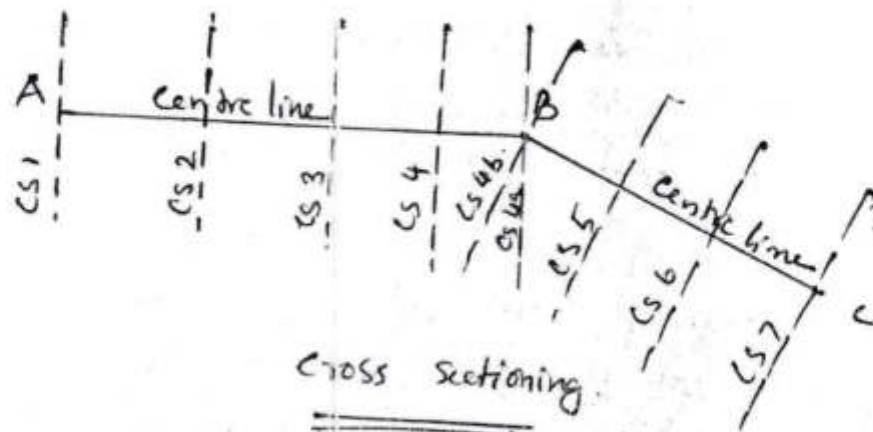
- a) Back bearing = $\theta_1 = FB + 180^{\circ} = 56^{\circ} 21' + 180^{\circ} 00'$
 $= \underline{\underline{236^{\circ} 21'}}$
- b) Back bearing = $\theta_2 = \underline{\underline{N 28^{\circ} 45' W}}$
- c) Back bearing = $\theta_3 = \underline{\underline{N 30^{\circ} 50' E}}$

(A)

5) Profile levelling is the process of determining the elevations of points at short measured intervals along a fixed line such as centre line of railway, highway, canal or sewer. It is also known as longitudinal sectioning.



cross sectioning:- Cross sections are run at right angles to longitudinal profile and on either side of it for the purpose of lateral outline of ground surface. They provide data for estimating quantities of earth work and for other purposes.



6) A contour is an imaginary line on the ground joining the points of equal elevation. It is a line in which the surface of ground is intersected by a level surface.

contour interval :- The vertical distance between any two consecutive contours is called contour interval. The contour interval is kept constant for a contour plan. The choice of proper contour interval depends up on

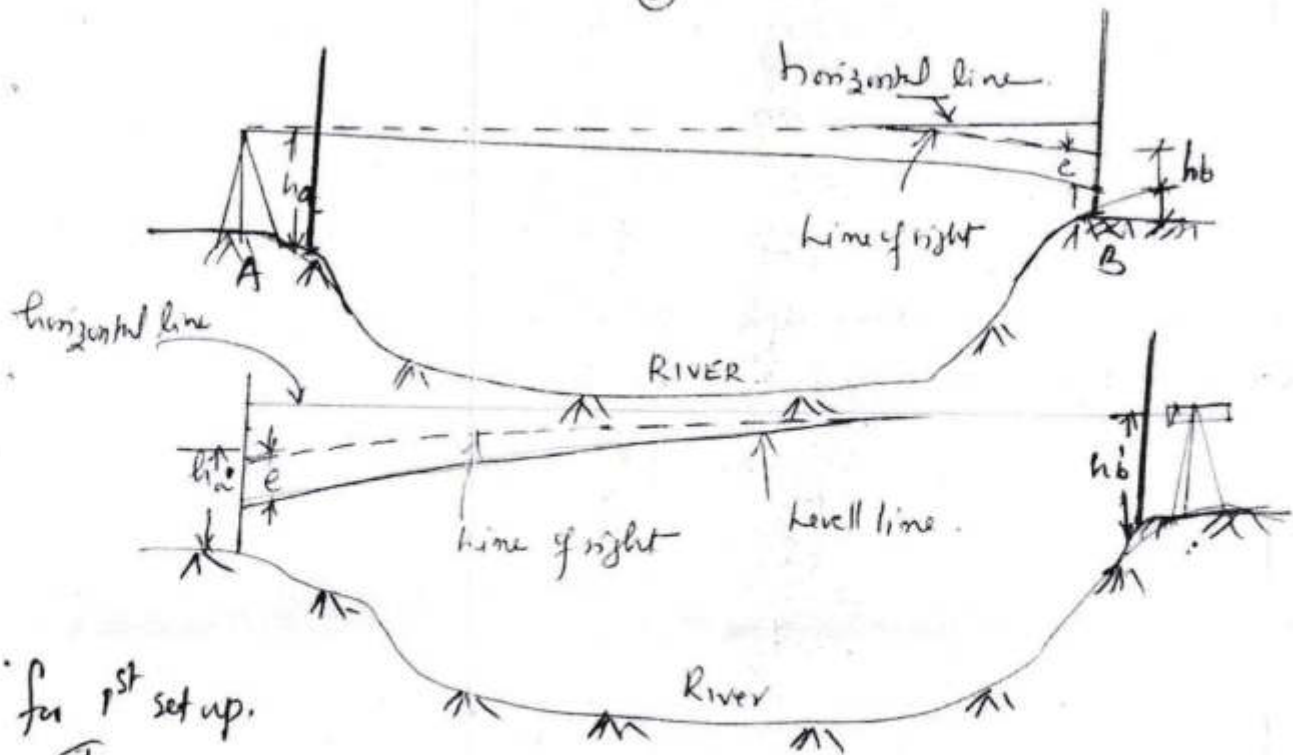
- (1) The nature of ground
- (2) The scale of map.
- (3) The purpose and extent of survey.
- (4) Time and expense of field and office work.

7) RECIPROCAL LEVELLING :- When it is necessary to carry levelling across a river or any obstacle requiring long sight between two points, reciprocal levelling is used - to eliminate

- 1) error in instrument adjustments
- 2) combined effect of earth's curvature and refraction of atmosphere
- 3) variations in average refraction.

• procedure :-

(6)



for 1st setup.

True Diff. in elevation

On A : h_a ; on B : $h_b - e$

$$= H = h_a - (h_b - e)$$

for 2nd setup.

On A - $h_a' - e$; on B, h_b'

True Diff. in elev = $H = (h_a' - e) - h_b'$

Taking average of two Differences in elev.

$$H = \frac{1}{2} [h_a - (h_b - e) + h_a' - e - h_b']$$

$$= \frac{1}{2} [(h_a - h_b) + h_a' - h_b']$$

True diff. in elev = Mean of the two apparent differences in elevation, obtained by reciprocal observations.

PART. C.

III.

a) Primary classification of Surveying are two.

(1) Plane Surveying. (2) Geodetic Surveying.

1) Plane Surveying is that type of Surveying in which the mean surface of earth is considered as plane and the spheroidal shape is neglected. All triangles formed by Survey lines are considered as plane triangles.

2) Geodetic Surveying:- In which the shape of earth is taken in to account. All lines lying in the surface are curved lines and triangles are spherical triangles. The object of geodetic surveys include work of larger magnitude and high degree of precision.

b) Intersection Method:- It is resorted to when the distance between the point and instrument station is either too large or cannot be measured accurately due to some field conditions. The location of object is determined by sighting at the object from two plane table stations (previously plotted) and drawing rays. The intersection of these rays gives the position of object. Two instrument stations (least) is needed and distance between them is base line. No levelling measurement other than base line is needed.

(fig)

(8)

$$\text{IV (i) Incorrect Lengths of chains} = L' = 30 - \frac{6}{100} \\ = 29.94 \text{ m.}$$

$$\text{Measured Lengths (L')} = 648 \text{ m}$$

$$\text{Hence True length} = L' \left(\frac{L}{L'} \right) \\ = 648 \left(\frac{29.94}{30} \right) \\ = \underline{\underline{646.70 \text{ m}}}$$

(b) Local attraction

A freely suspended properly balanced magnetic needle always points towards the magnetic north. The magnetic needle is disturbed from its normal position if it is under the influence of external attractive forces (electric cable, bunch of keys, iron buttons) such forces are known as local attraction. There may be slight change in FB and BB of the lines from single station which is under local attraction.

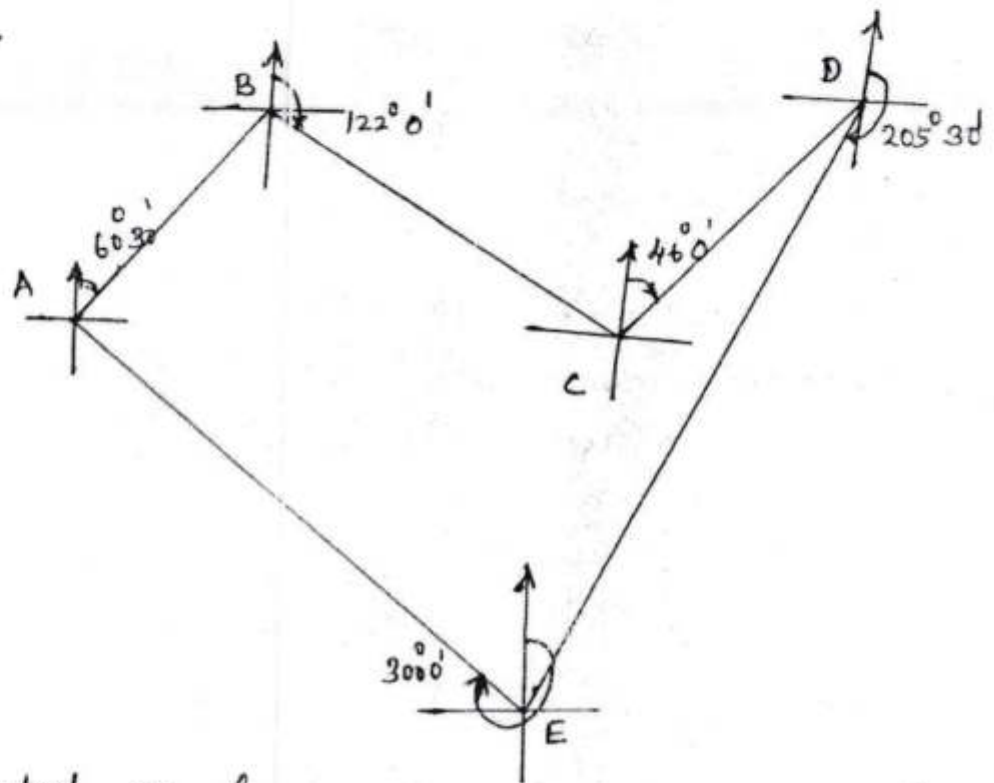
"Local attraction is a term used to denote any influence such as the above, which prevents the needle from pointing to the magnetic north in a given locality.

Detection :- The local attraction at a particular place can be detected by observing the fore and back bearing of each line and finding its difference. If difference between FB and B.B is 180° , it may be taken that both stations are free from local attraction, if diff. is other than 180° .

(9)

The fore and back bearing should be measured again to find out whether the discrepancy is due to avoidable attraction from the article on person, chain, tape etc. If the difference still remains, local attraction exists at one or both the stations.

Q. a) Soln.



Included angle = Bearing of previous line -
Bearing of next line.

$$\begin{aligned} \angle A &= \text{Bearing of } AE - \text{Bearing of } AB \\ &= (300^\circ - 180^\circ) - 60^\circ 30' = \underline{\underline{59^\circ 30'}} \end{aligned}$$

$$\begin{aligned} \angle B &= \text{Bearing of } BA - \text{Bearing of } BC \\ &= 60^\circ 30' + 180^\circ - 122^\circ 0' = \underline{\underline{118^\circ 30'}} \end{aligned}$$

$$\begin{aligned} \angle C &= \text{Bearing of } CB - \text{Bearing of } CD \\ &= 122^\circ 0' + 180^\circ - 46^\circ = \underline{\underline{256^\circ}} \end{aligned}$$

(10)

$$\angle D = \text{Bearing of DC} - \text{Bearing of DE}$$

$$= 46^\circ + 180^\circ - 205^\circ 30' = 20^\circ 30'$$

$$\angle E = \text{Bearing of ED} - \text{Bearing of EA}$$

$$= 205^\circ 30' - 180 - 300 + 360 = 85^\circ 30'$$

$$\text{Sum} = (2n - 4) 90^\circ = (5 \times 2 - 4) 90$$

$$= (10 - 4) 90 = 540$$

$$\text{Sum of angles} = 59^\circ 30' + 118^\circ 30' + 256^\circ + 20^\circ 30' + 85^\circ 30'$$

$$= \underline{\underline{540^\circ 00'}}$$

OR.

VI.
(a)

Item	Prismatic Compass	Surveyors Compass
1) Magnetic Needle.	The needle is of broad needle the needle does not act as index.	The needle acts as index also.
2) Graduation	The graduations are in WCB system. having 0° at South end, 90° at West, 180° at North, and 270° at East.	The graduations are in QB system having 0° at N and S and 90° at East and West.
3) Reading	The reading is taken with the help of prism provided at eye slit.	The reading is taken directly through glass top.
	Sighting and reading can be done simultaneously.	Cannot be done simultaneously.
Tripod	Tripod may or may not be provided.	Must not be used without Tripod.

VI

(b) Advantages

- 1) The plan is drawn by the Surveyor himself while the country is before his eyes, and therefore, there is no possibility of omitting the necessary measurements.
- 2) Surveyor can compare plotted work with the actual features of the area.
- 3) Since the area is in view, contour and irregular objects, may be represented accurately.
- 4) Notes of measurements are seldom required, and possibility of mistakes in booking is eliminated.
- 5) Particularly useful in magnetic areas where compass may not be used.
- 6) It is simple and cheaper than theodolite, or any other type of survey.
- 7) Most suitable for small scale maps.

Disadvantages

- 1) Since Notes of measurements are not recorded, it is great inconvenience if the map is required to be reproduced to some different scale.
- 2) It is not intended for very accurate work.
- 3) It is essentially a tropical instrument.
- 4) Most inconvenient in rainy season.
- 5) Due to heaviness inconvenient to transport.

VII)

a) The temporary adjustments for a level are

- (1) Setting up of the level
- (2) Levelling up
- (3) Elimination of parallax.

1) Setting up consists of (a) fixing inst. on stand
(b) Levelling inst. approximately by leg adjustment.

2) Levelling up:- After having levelling up accurate levelling is done with the help of foot screws and with reference to plate levels. The purpose of levelling is to make vertical axis truly vertical. There are three levelling screws or four levelling screws.

3) Elimination of parallax:- It is a condition arising when the image formed by objective is not in plane of cross hairs. Unless parallax is eliminated accurate sighting is impossible. It can be eliminated by (1) focusing the eye piece (2) Focusing the objective.

b) There are two methods of booking and reducing the elevations of points from the observed staff readings. 1) collimation or Height of Inst. method (2) Rise and fall method.
In the height of Inst. method the height of Inst. is

13

calculated for each set up of Inst. by adding Back sight to the elevation of B.M. The elevn. of turning point is then calculated by subtracting ^{from} H.I. the fore sight.

2) Rise and fall method:- In rise and fall method the height of Inst. is calculated but the diff. of level between consecutive points is found out by comparing the staff readings on the two points for the same setting of the Inst. The diff. between their staff reading indicates a rise or fall according as the staff reading at the point is smaller or greater than that the preceding point.

Comparison of two Methods:- The H.I. method is more rapid, less tedious and simple. However checks on the calculation of intermediate sights is not available. the mistakes in their levels pass unnoticed.

The rise and fall method though more tedious provides full check in calculations for all sights. In case there is required to take a number of readings from same Inst. setting, H.I. method is more suitable.

VIII. Soln

Station	BS	I.S	F.S	H.I	RL	Remarks
P	1.622			84.820	83.198	
	1.874		0.354	86.340	84.466	
	2.032		1.780	86.592	84.560	
Q		2.362		86	84.230	
	0.984		1.122	86.454	85.470	
	1.906		2.824	85.536	83.630	13 m.
			2.036		83.500	

$$\sum BS = 8.418$$

$$\sum FS = 8.116$$

First RL - Last RL

$$83.50 - 83.198$$

$$= \underline{\underline{0.302}}$$

$$\begin{aligned} \sum BS - \sum FS &= 8.418 - \\ &\underline{8.116} \\ &= \underline{\underline{0.302}} \end{aligned}$$

Hence checked.

IX.
a)

Characteristics of Contours:-

- Two contour lines of different elevations cannot cross each other. If they have did the point intersection would have two different elevations which is absurd.
- Contour lines of different elevations can unite to form only in the case of a vertical cliff.
- Contour lines close together indicates steep slope.

If they are far apart indicate gentle slope. If they are equally spaced uniform slope is indicated. A series of straight, parallel and equally spaced contours represent a plane surface.

4. A contour passing through any point is at right angles to the line of steepest slope at that point.
5. A closed contour line with one or more higher ones inside represent a hill, and a closed contour line with one or more lower ones inside represent a pond or depression.
6. A contour line crosses a watershed or ridge line at right angles.
7. A contour line crosses valley line at right angles.

IX.

b) 1. Instrumental errors.

- (a) due to imperfect adjustment
- (B) due to sluggish bubble
- c) due to movement of objective slide
- (d) Rod not standard length

2. Natural errors

- (a) Earth's curvature
- (b) Refraction
- (c) Temperature variations
- (d) Settlement of Tripod (e) Wind vibration

(16)

3. personal errors:-

- (a) Mistakes in manipulation
- (b) " " rod handling
- (c) Errors in sighting.
- (d) Mistakes in reading rod.
- (e) " " recording and computing.

X.

When the observations are taken from 'P' the apparent difference in elevation between

P and Q = $2.748 - 1.824 = 0.924\text{m}$,
 'P' being higher

When observations are taken from Q, the apparent diff. in elvn between P and Q.

= $1.606 - 0.928 = 0.678$; P being lower

Hence True difference in elevation } = $\frac{0.924 + 0.678}{2} =$

= 0.801m , 'P' being higher

(a) True Elevation of Q

= $126.386 - 0.801$

= 125.585m .

(b) Combined Correction for } = $0.06728d^2 = 0.06728(1.010)^2$
 (curvature and refraction)
 (Q appears to be lower by 0.069m due to $\frac{0.069\text{m}}{1.010}$ effect)