Scheme of valuation

Revision: 2015

Course Title: Surveying I — Course Code: TED (15) 2011

I	PART A			
1	The two basic principles of surveying are			
	a) working from whole to part	1	2	2
	b) Location of a point by measurement from two points of reference	1		
2	a) Gunter's chain or surveyor's chain	0.5		
	b) Reverse chain	0.5	2	2
	c) Metric chain	0.5		
	d) Engineer's chain	0.5		
3	a) closing error — It is the distance by which the end of the traverse falls short in coinciding with the starting point of the traverse	1		

	b) Magnetic Declination The angle between the magnetic meridian at a point and geogeaphical meeidian	1	2	2
4	Majoe paets of a dumpy level			
	a. Telescope	0.5		
	b. Bubble tubes			
	c. Compass	05		
	d. Veetical spindle		2	2
	e. Teibeach sceews	0.5		
	f. Foot sceews			
	g. Levelling head	0.5		
	h. Teipod			
5	Inteepolation is the peocess of spacing of contoues peopoetionately between the plotted geaund points established by indiect methods	2	2	2

PART B

II

1) Various opeeations involved in chain sueveying aee

a) Maeking the Stations

The fiest step in chain sueveying is to decide and locate stations so that they aee distinctly visible and quasi-peermanently fixed dueing the sueveyoe's peocess. 1.5

b) Ranging.

- It is the peocess of establishing a numbee of intee mediate points on a sueveying line joining two stations in the field 1.5

- It is necessaey to ensuee that measueements aee made in a steaight path along the sueveying line

	c) Measurement of survey lines After fixing the survey stations and ranging survey lines by locating the intermediate stations, the next step in chain surveying is to measure the horizontal distances along the survey lines and the distance of features of interest from the survey line so that a representative and authentic survey map is constructed	1.5	6	6
	d) offset measurements - The important details of features in the vicinity of survey lines are located by means of offset - offsets upto or less than 15m are termed short offsets while larger than 15m are called long offsets	1.5		

2 a) An instrument station 'P' is chosen on the ground from which all detail points A, B, C, D & E are visible

b) The plane table is set up on the station P and is centred and levelled.

c) By using U-fork, the station P is located on drawing paper as 'p'.

d) Pivoting the alidade about 'p', the detail point A is sighted and draw a ray 'pA' along the fiducial edge of alidade.

e) Similarly, all other points are sighted (detail points B, C, D & E) and draw rays pB, pC, pD, pE

f) Now the ground distances PA, PB, PC, PD, PE is measured by direct chaining

g) By taking a suitable scale the distances are plotted on their respective rays as pa, pb, pc, pd & pe

h) All points are joined on the drawing sheet

4

6

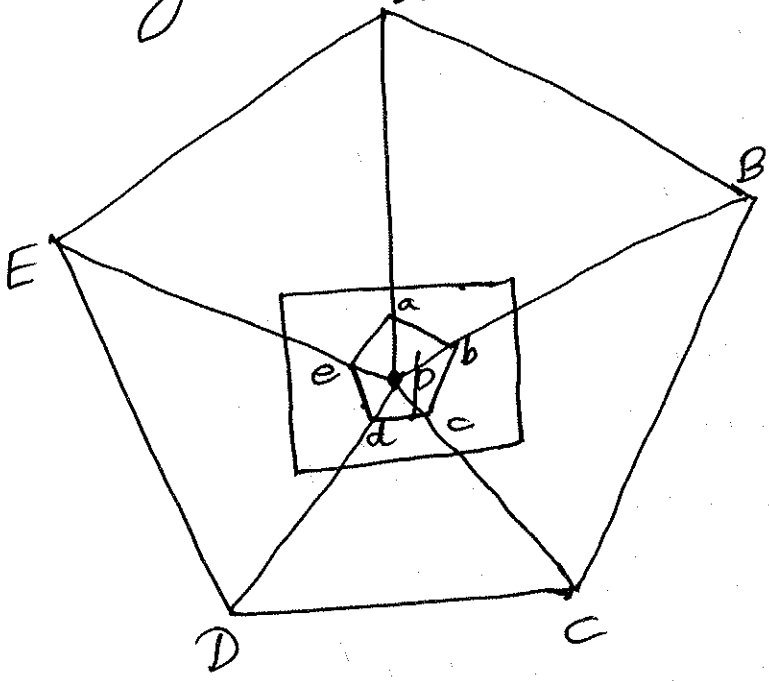


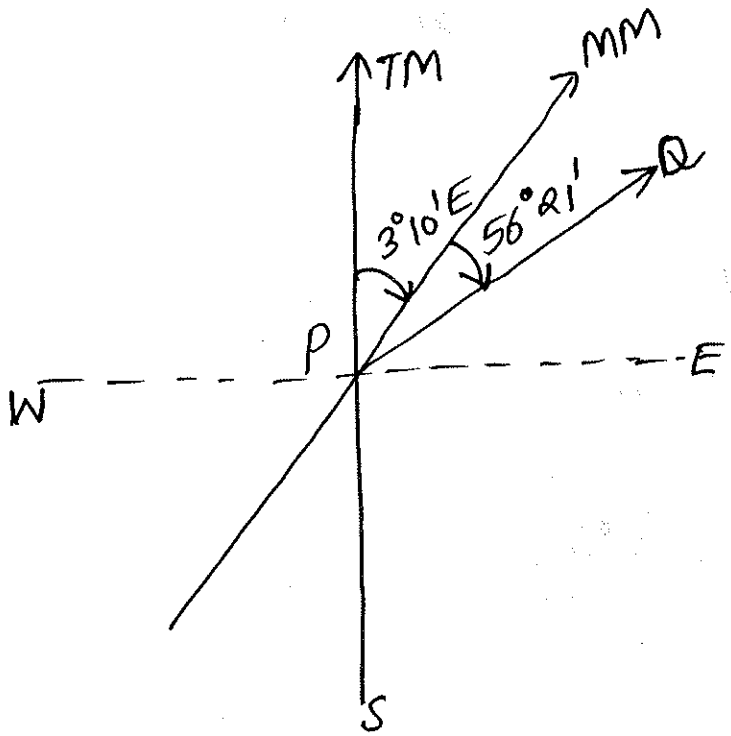
fig 2 Marks

3. True bearing of line PQ
= Magnetic bearing + Declination
(since declination towards east)

True bearing of line PQ

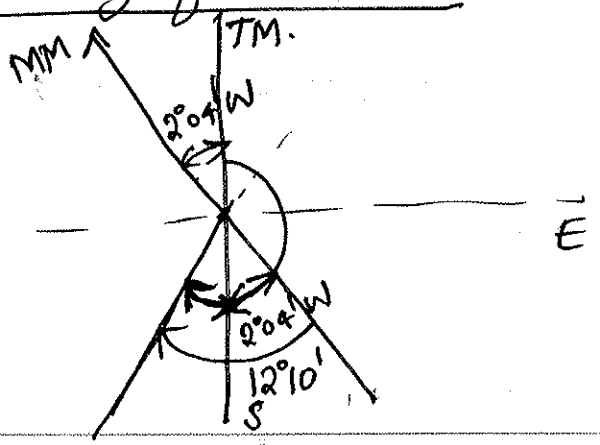
$= 56°21' + 3°10'$

$= \underline{59°31'}$



3.

True bearing of line RS



	True bearing of line RS = Magnetic Bearing − Declination = 12°10' − 2°04' = S 10°6' W	3	6	6
4)	Benchmark is a fixed point of known elevation above datum Types of benchmark. a) Arbitary Benchmark −While doing levelling of a small area arbitary benchmark is used −Its elevation is assumed arbitarily.	1.5		
	b) Permanent benchmarks: −established by either Survey of India or Public work Department	1.5		

	c) Temporary benchmark: – It is temporary established for a small time whenever needed	1.5		
	d) GTS Benchmark: Great Tergonometrical Suevey established by Suevey of India Depaetment theaghout the countey	1.5	6	6.
5)	– The axis of level tube should be peependicular to the veetical axis – The horizontal cross hair should be in a plane peependicular to veetical axis so that when the instrument is peopeely levelled, it will be in a horizontal plane – The line of sight should be parallel to the axis of level tube		6	6

	-The line of sight, axis of the objective lens and optical axis should coincide			
6)	Contour Contours are imaginary lines that join the places having the same height above sea level	2		
	Contour interval It is the difference in elevation between two contour lines that are side by side	2		
	Horizontal equivalent The horizontal distance between any two consecutive contours for a given slope	2		

7)	Distance $= 3400m = \frac{3400}{1000}$	1		
	$= 3.4km$			
	Correction for curvature			
	$C_c = -0.0785 d^2$ where			
	d is in km	1		
	$= -0.0785 \times (3.4)^2$			
	$= -0.90746$		6	6
	Correction for refraction			
	$C_R = 0.01122 d^2$			
	$= 0.01122 \times (3.4)^2$	2		
	$= 0.1297032$			
	Combined correction for curvature & refraction			
	$C = -0.0673 d^2$			
	$= -0.0673 \times (3.4)^2$	2		
	$= -0.777988m$			

PART C

III a) 1) Chaining Free, Vision obstended

The ends of lines are not intervisible eg: rising ground, hill or jungle.

(i) Both ends may be visible from any intermediate point lying on the line such as in the case of a hill

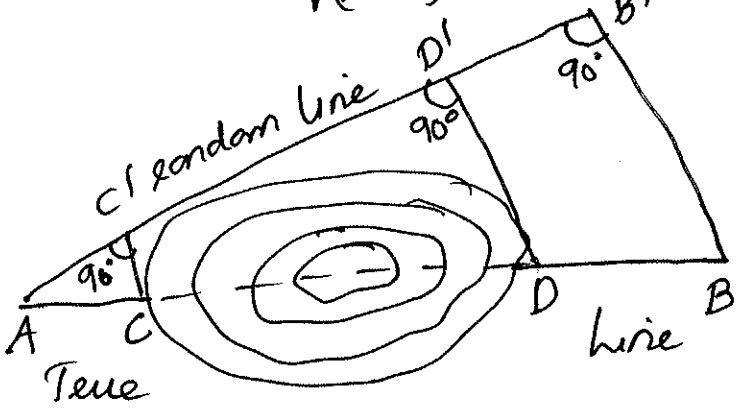
The obstacle of this kind may be crossed over by reciprocal ranging and length measured by stepping method of chaining.

(ii) Both ends may not be visible from any intermediate point such as in the case of a jungle.

The obstacle of this kind can be crossed over by "Random line method"

Let AB be the line whose length is required. From A, run a line AB' called a random line in the convenient direction of AB and continue it until point B is visible from B'. Chain the line to B' where BB' is perpendicular to AB' and measure BB'

Then $AB = \sqrt{(AB')^2 + (BB')^2}$ 2



2) Chaining obstructed vision free

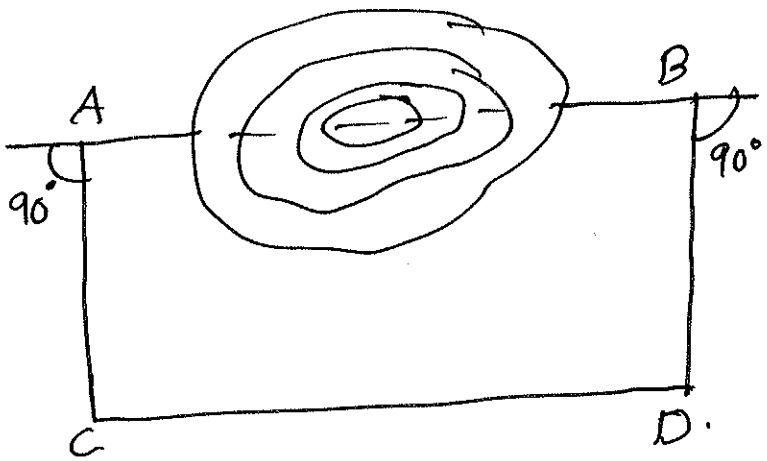
Typical obstacle is a sheet of water, the width of which in the direction of measurement exceeds the length of chain or tape

Two cases

(i) when the obstacle can be chained around eg: a pond, a hedge etc.

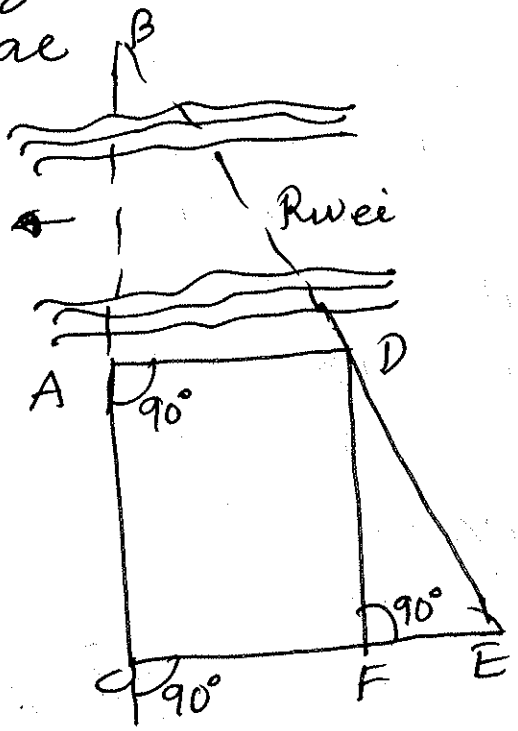
Solutions to overcome

a) set out equal perpendiculars AC and BD. Measure CD which is equal to AB



(ii) when the obstacle cannot be chained around eg: a river

Select two points A & B on the chain line on opposite banks of the river. From A & C, erect perpendicular or parallel lines AD and CE such that E, D & B are in line. Measure AC, AD & CE. If a line DF is drawn parallel to AC, meeting CE in F, the triangles ABD and FDE are similar



$\frac{AB}{AD} = \frac{DF}{FE}$ (But $DF = AC$ and

$FE = CE - CF = CE - AD$

$\frac{AB}{AD} = \frac{AC}{CE-AD}$

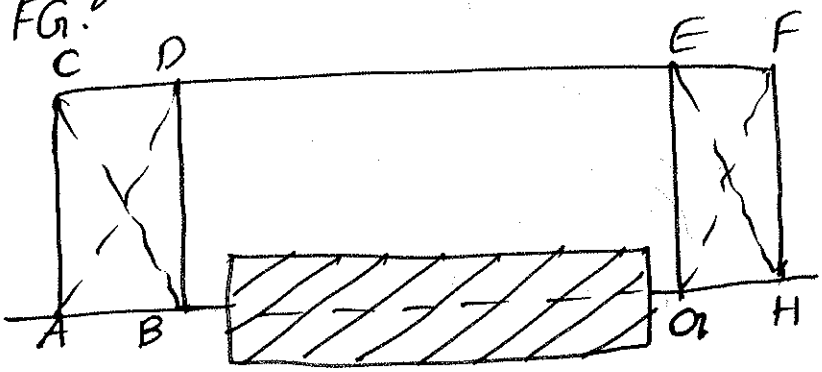
or $AB = \frac{AD \times AC}{CE-AD}$. 4

3) chaining and vision both obstended

A building is a typical example.

Select two points A & B on the chain line. At A and B, erect equal perpendiculars AC and BD. Join CD and produce it past the obstacle. Select two points E & F on it. At E & F, set out perpendiculars EG & FH, each equal in length to AC. The points G & H then lie on the chain line and BG = DE.

The directions and length of perpendiculars must be set out with great accuracy. The check

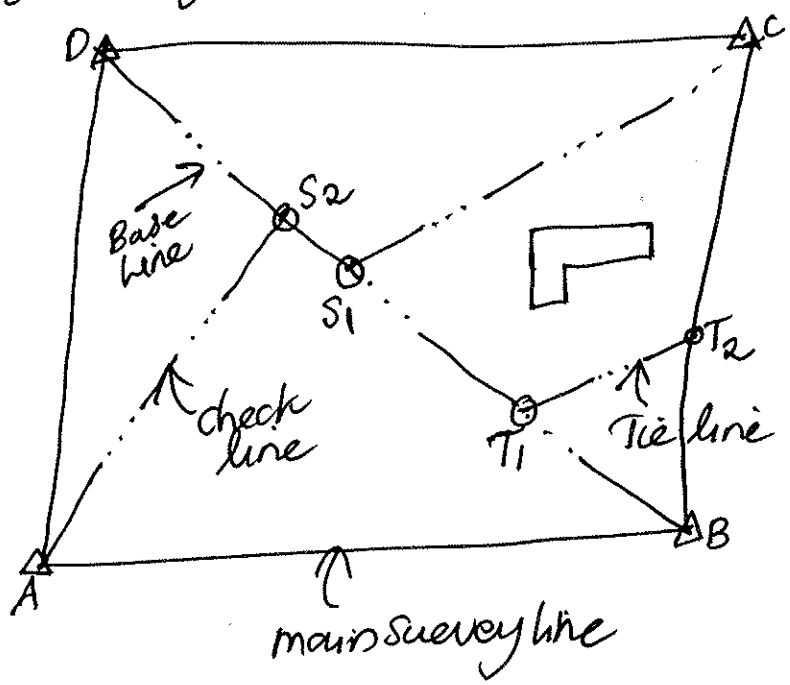
	can be made by measuring diagonals of the rectangles. For the same rectangle, diagonals should be equal. Here AD should be equal to BC, and EH equal to FG. 	3	9	9.
III b)	Base line The survey lines between main stations are called main survey lines or chain lines. The largest of the main survey line is called Base line Tie lines The line joining the subsidiary stations / tie stations	1		

on main line is teemed as tie lines

They are run to account for interior details on the area 2

check line

- The survey lines that are run for cross checking the accuracy of survey measurements 1
- There should be at least one check line in each triangle of the framework



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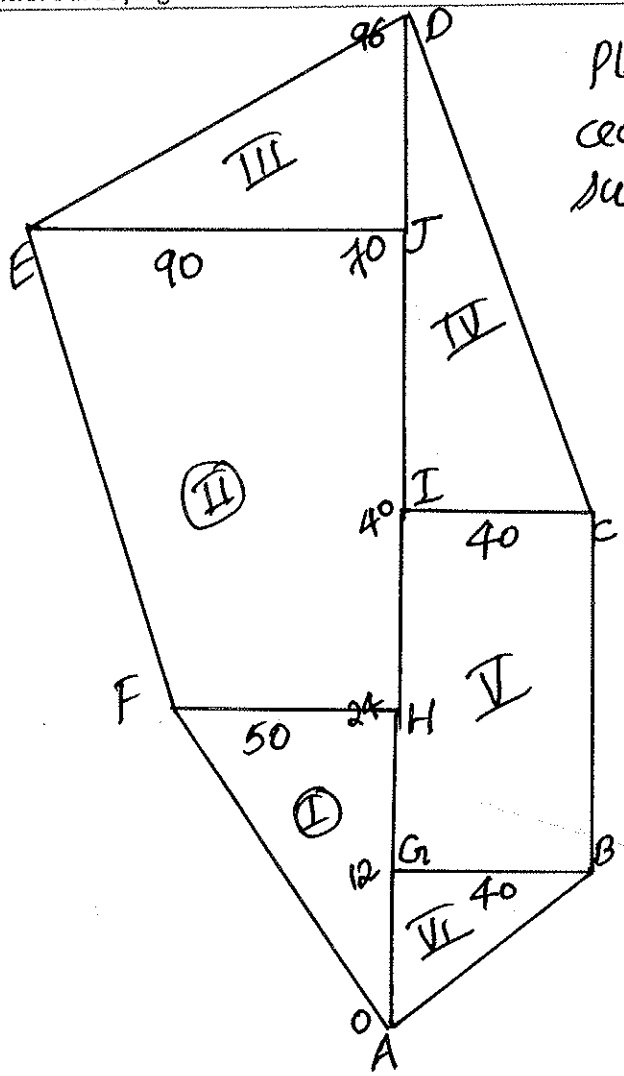
IV a)



Plot of cross staff survey

1

Area of triangle AFH

$= \frac{1}{2} \times \text{base} \times \text{height}$

$= \frac{1}{2} \times 24 \times 50 = 600 \text{ units}$

Area of trapezium EFHJ

$= \frac{\text{Height 1} + \text{Height 2}}{2} \times \text{Base}$

$= \frac{1}{2} \times (90+50) \times (70-24)$

$= 3220$ units

Area of triangle EDJ

$= \frac{1}{2} \times$ base $\times$ height

$= \frac{1}{2} \times 90 \times (96-70)$

$= 1170$ units

Area of triangle DIC

$= \frac{1}{2} \times 40 \times (96-40)$

$= 1120$ units

Area of rectangle GICB

$= 40 \times (40-12)$

$= 1120$ units

Area of triangle AGB

$= \frac{1}{2} \times 40 \times 12$

$= 240$ units

Total area of field ABCDEF

$= 600 + 3220 + 1170 + 1120 + 1120 + 240$

$= \underline{7470 \text{ units}}$

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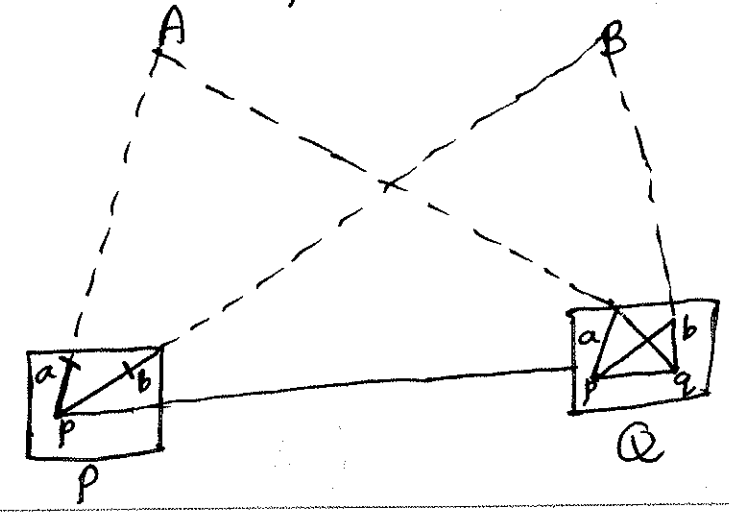
IV 6)	**Intersection method** – In this method a point can be located by plotting two rays from two known stations – P & Q are the known stations – First the equipment is placed on P and plot the lines by sighting the stations A, B & Q. – Then shift the instrument to station Q and plot the lines by sighting stations A, B & P. – Finally the intersection of A and B rays is the required location of point of intersection  	4 2	6	6

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V a)	Stations R & S are free from local attraction since there fore bearing and back bearing differ exactly by 180°	1		
	F.B of SP = 289°30'			
	B.B of SP = 289°30' − 180°0' = 109°30'	2		
	observed B.B of SP = 108°45'			
	error = −45'	1		
	F.B of PQ = 44°30' + 0°45'			
	= 45°15'	1	9	9
	B.B of PQ = 180° + 45°15'			
	= 225°15'	2		
	observed B.B of PQ = 226°30'			
	error = +1°15'			
	F.B of QR = 124°30' − 1°15'	1		
	= 123°15'			
	B.B of QR = 180° + 123°15'			
	= 303°15'			
	Stations P & Q are affected by local attraction	1		

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V b)	1) Cylindee shaped metal box compass and its whole body is peoteded by a aylindeical box.	1		
	2) Pivot supports a magnetic needle that is suspended feely.	1		
	3) Magnetic Needle The needle, when feely hanging on any support, always maintains its two ends pointed in dieection of noeth-south pole.	1	6	6
	4) Geaduation aiele maeked with 0° to 360° to measuee all line beaeings.	1		
	5) Peism geaduation of eing can be eead using a peism peecisely	1		
	6) object vane	1		
	7) eye vane			

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VI a)	Stations C & D are not affected by local attraction since the fore bearing and back bearing differ exactly by 180°	1		
	F.B of DE = 257°00'			
	B.B of DE = 257°00' − 180°00' = 77°00'	2		
	observed B.B of DE = 75°30'			
	error = −1°30'			
	FB of EA = 295°30' + 1°30' = 297°00'	2	9	9
	B.B of EA = 297°00' − 180°00' = 117°00'			
	observed B.B of EA = 116°30'			
	error = −30'			
	F.B of AB = 55°00' + 30' = 55°30'	2		
	B.B of AB = 180°00' + 55°30' = 235°30'			

	Observed B.B of AB = 234°00' error = −1°30' F.B of BC = 112°30' + 1°30' = 114°00' B.B of BC = 180°00' + 114°00' = 294°00' = observed B.B of BC	2		
VI b)	Bearing of a line is always measured clockwise w.r.t some reference line or direction. This fixed line is known as meridian	1		
	Types of meridian 1) True Meridian It is the reference direction of north pole of earth from a given station point	1		

	2) Magnetic Meridian It is the direction of north pole indicated by a magnetic needle 3) Arbitary meridian – This is any assumed direction to a well defined object – It may be useful for small areas eg: A Mosque can be taken as reference – Direction of magnetic north with respect to true north is called magnetic direction	1 2	6	6

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VII a)

Stn	B.S	I.S	F.S	H.I	R.L	Remarks
A	2.225			137.775	135.75	BM
B		1.605			136.370	
C	2090		0.995	139.07	136.980	Change Point
D		2.865			136205	
E	0.600		1.265	138.405	137.805	Change Point
F	1.045		1.985	137465	136.420	Change Point
G			2.685		134.78	
Sum	5.96		6.93			

7

$\Sigma B.S = 5.96$, $\Sigma F.S = 6.93$

$\Sigma B.S - \Sigma F.S = -0.97$

9 9

Last R.L − First R.L

$= 134.78 - 135.75$

$= -0.97$

2

VII b) Types of levelling staff.

1. Self Reading Staff.

- A normal staff that has graduations imprinted on them
- These graduations are read by the instrument person viewing through telescope

3 forms of self reading staff

- Solid staff: ordinary staff of full height with readings imprinted on them 4
- Folding staff: equipped with hinged joints in the middle of their length.
- Telescopic staff: These are equipped with telescopic joints in such a way that they can be extended to their full length.

2. Taeget Staff. — These aee equipped with sliding baes with a taeget on top of it. — A taeget is a eound oe oval plate maeked in quaetees in conteasting coloes such as ted and white in opposite quaetees. — These eods aee used when geaduations aee not pecpeely seen. — The insteument peeson is teying to align ceoss hae of telescope to match it with the taeget — The taeget is adjusted abave oe below by the staff peeson	2	6	6

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VIII a)

Stn	B.S	I.S	F.S	H.I	R.L	Remarks
A	1.820			51.820	50.000	BM
B		2.150			49.67	
C		-1.230			53.05	
D		-1.460			53.280	
E	2.345		0.905		50.915	CP
F		1.995			51.265	
G			1.860		51.400	
Sum	4.165		2.765			

7

9

9.

$\Sigma B.S = 4.165$, $\Sigma F.S = 2.765$

$\Sigma B.S - \Sigma F.S = 4.165 - 2.765$

$= 1.4$.

2

Last R.L − First R.L

$= 51.400 - 50.000 = 1.4$

$\therefore \Sigma B.S - \Sigma F.S =$ Last R.L − First R.L

(30) of (39)

VIII b)	**Temporary adjustments of a dumpy level**			
	1. Setting up the level: This operation includes fixing the instrument to the tripod and levelling the instrument approximately by the leg adjustment.	2		
	2. Levelling up. – Accurate levelling to be done with the help of foot screws and with reference to plate levels.	2	6	6
	3. Elimination of Parallax. – By focusing the eyepiece for distinct vision of the cross-hairs – By focusing the objective to bring the image of the object in the plane of cross hairs	2		

IX a) -Longitudinal sectioning is the process of establishing the elevation of sites on the ground at about regular intervals along a continuous line

-It is one of most typical applications of running levels and vertical distance measuring 2

-The data is represented as a profile which is a representation of vertical cross-section

-The primary objective of longitudinal sectioning is to determine the slope, grade & vertical alignment of surveyed feature

The process of creating a longitudinal section involves the following steps.

1. Establishing a base line

– A steaight line is maeked along the path of the feature being sueveyed 2.5

– This line seeves as the refeeence fue all subsequent measueements.

2. Taking elevation measueements

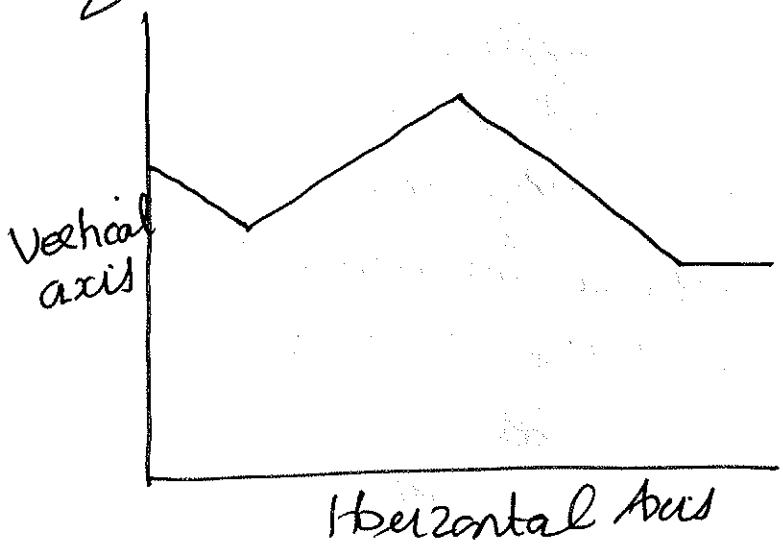
– At eegular intevals alang the base line, sueveyoe's measuee the elevation of geound sueface using an insteument like a levelling 2.5 insteument oe total station

– These measueements aee ecoeded to create a pevfile of the land

3. Plotting the profile

— The collected elevation data is plotted on graph paper or entered into specialized software to create a longitudinal section

— The resulting graph shows the variations in ground level along the surveyed line 2 9 9.



IX b)	Characteristics of contour lines 1- Contour lines connect points of equal elevation 2. Steep slopes are shown by closely spaced contour lines 3. Gentle slopes are shown by widely spaced contour lines 4. Contour lines do not intersect, branch or cross. 5. They may merge in the case of an overhanging cliff 6. contour lines always close either on the map or on adjacent map sheets. 7. Uneven surface is represented by irregular contours. 8. Contours do not take sharp turnings.		6	6.

X a) Cross sectioning.

- Involves the creation of horizontal cross-sectional views of the land perpendicular to alignment being surveyed
- provides valuable information about the terrain's shape, dimensions and features at specific locations 1

The process involves the following steps:

1) Establishing cross-section lines
- Surveyors mark perpendicular lines to the alignment being surveyed at regular intervals 2
- These lines are known as cross-section lines or station lines

	2. Taking measurements — Along each cross-section line, surveyors measure the ground level at predetermined intervals using levelling instrument or total station — Additional measurements may be taken for features such as buildings, utilities or natural elements.	3	9	9
	3. Plotting the cross-section — The measured data is then plotted on graph paper or entered into specialized software to create a cross section — The resulting diagram provides a detailed view of the land's features and elevation along the surveyed line	3		

X b)	(i) Factoes affecting selecban of contoue inteeval – The scale of the map – puepose of the map. – Nabuee of geaund – Tine & cost. – slope (ii) uses of a contoue map. – peovides infoemabon regaeding featuees of geand – sechons may be easily deawn feom a contoue map in any diecbon – Inteevisibility between two geand points plotted on map can be asceetained – helps to appeoximately select the most economical oe suitable site foe a pejeet	2		

	– A route of given grade can be teaced on the map. – capacity of a reservoir and catchment area may be determined from contour maps. – may be used to determine the quantities of earthwork (Any valid 4 points)	4	6	6

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