SCHEME OF EVALUATION

REVISION : 2015
COURSE TITLE : SURVEYING 1 **COURSE CODE : 2011**

Qst. No	SCORING INDICATOR	SPLIT UP SCORE	SUBTOTAL	TOTAL
	PART A			
I(i)	1. a) A plane table with levelling head b) Alidade c) plumbing fork and plumb bob d) Spirit level e) Trough compass f) Drawing paper with a rainproof cover	Any four accessories	2 marks	2 marks
I (ii)	Magnetic declination at a place is the horizontal angle between the true meridian and the magnetic meridian shown by the needle at the time of observation	Definition	2 marks	2 marks
I (iii)	a) Self reading staff : solid staff, folding staff, telescopic staff b) Target staff	Four types	2 marks	2 marks
I (iv)	The vertical distance between any two successive contours is called contour interval.	Definition	2 marks	2 marks
I (v)	$C = 0.06728\ d^2$ m, C = combined correction, d= distance in m.	Formula with notations	2 marks	2 marks
	PART B			
II(1)	Indirect ranging is resorted to when both the ends of the survey line are not inter visible either due to high intervening ground or due to long distance between them. In such a case, ranging is done indirectly by selecting two intermediate points M1 and N1 very near to the chain line in such a way that from M1, both N1 and B are visible and from N1, both M1 and A are visible. Two surveyors station themselves at M1 and N1 with ranging rods. The person at M1 then directs the person at N1 to move to a new position N2 in line with M1B. the person at N2 then directs the person at M1 to move to a new position M2 in line with N2A. thus, the two persons are now at M2 and N2 which are nearer to the chain line than the positions M1 and N1. The process is repeated till the points M and N are located in such a way that the person at N in line with MB, and the person at M in line with NA. After having established M and N, other points can be fixed by direct ranging.	Definition Procedure Figure	2 marks 2 marks 2 marks	6 marks

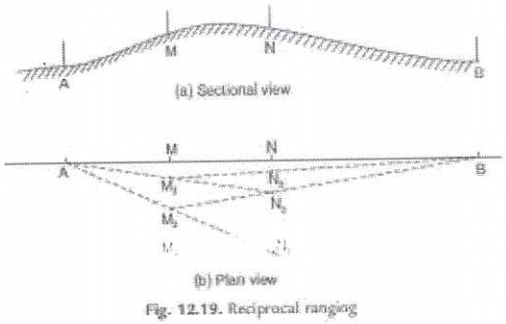
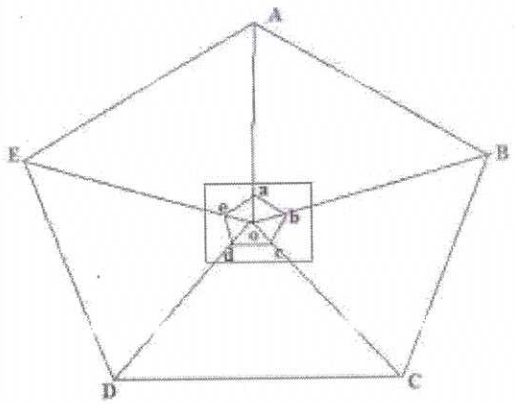


Fig. 12.19. Reciprocal ranging

II(ii)

Radiation method is generally employed for locating the details. In this method, a ray is drawn from the instrument station towards the point, the distance is measured between the instrument station and that point, and the point is located by plotting to some scale the distance so measured. The method is suitable when the distances are small and one single instrument can control the points to be detailed.



Procedure 4 marks

Figure 2 marks

6 marks

II (iii)

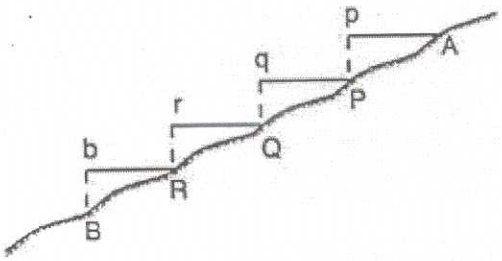
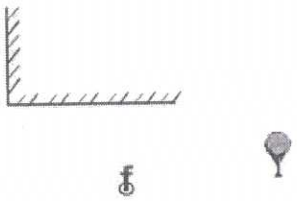
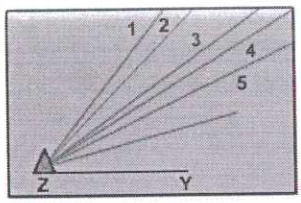
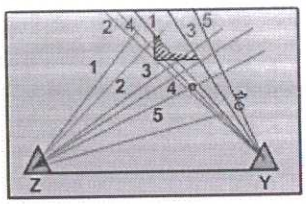
tic compass	**or's compass**
dle is of broad type. The needle does not acts as an index	dle is of edge bar type. dle acts as the index also
duations are in W.C.B system	ions are in Q.B system
ions are engraved inverted	ions are engraved erect
g is taken with the help of a prism provided at the eye slit	g is taken by directly seeing the top of the glass
g and reading taking can be done simultaneously	g and reading taking cannot be multaneously
l may or may not be provided	strument cannot be used t a tripod

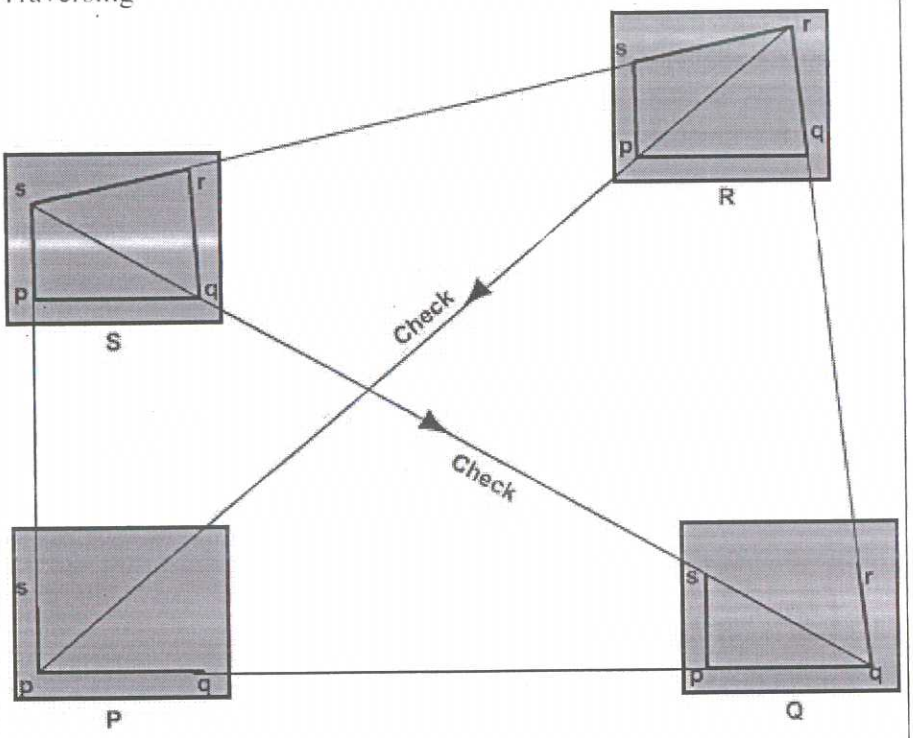
Any 6 differences

1 x 6 = 6marks

6 marks

II (iv)	A) 1. S 9^0 48' E 2. S 31^0 54' W 3. N 32^0 36' W B) 1. $148^0$24' 2. $248^0$6' 3. $354^0$18'	Q. No. A Q.No. B	3 marks 3 marks	6 marks
II (v)	a) Great trigonometrical survey benchmark A **G.T.S.** (Great Trigonometrical Survey) **benchmark** is a permanently fixed reference survey station (or point), having known elevation with respect to a standard datum (mean sea level). These are established all over India by Survey of India department with greater precision b) Permanent benchmark A readily identifiable, relatively **permanent**, recoverable **benchmark** that is intended to maintain its elevation without change over a long period of time with reference to an adopted datum, and is located where disturbing influences are believed to be negligible. c) Temporary benchmark A **temporary benchmark** (TBM) is a fixed point with a known elevation used for level control during construction works and surveys. Nails in road seals, or **marks** on kerb & channel are commonly used as **temporary benchmarks**. d) Arbitrary bench mark A benchmark which is arbitrarily selected for a survey.	Any three types with definition	3 x 2 = 6	6 marks
II (vi)	a. Drawing of sections b. Determination of inter visibility between two points c. Tracing of contour gradients and location of route d. Measurement of drainage areas e. Calculation of reservoir capacity	Any 4 uses	1.5 x 4 = 6	6 marks
II (vii)	Sensitiveness of a bubble tube id defined as the angular value of one division of the bubble tube. Sensitiveness of a bubble tube can be increased by: 1. Increasing the internal radius of the tube 2. Increasing the diameter of the tube 3. Increasing the length of the bubble 4. Decreasing the roughness of the walls. 5. Decreasing the viscosity of the liquid.	Definition Any four methods	2 marks 4 marks	6 marks
	PART C			
III.a	**UNIT 1** III. a. Direct method : stepping	explanation	1.5mar	

		with figure	ks	
	Indirect methods : 1. Angle measured : D = ΣL cosθ 2. Difference in level measured, D = $\sqrt{l2 - h2}$ 3. Hypotenusal allowance  CHAINING BY STEPPING METHOD FIG. 2.19		1.5 marks 2 marks 2 marks	7 marks
III (b)	Intersection method    Let us consider plane table stations Z and Y from which details got plotted by method of intersection. In this, first the plane table is set over the station Z, clamped and its position is plotted on paper as z. If the position of the station is not already plotted, then the station Y is bisected and plotted by method of radiation. Now, with alidade pivoted at z, salient object points on the surface of earth such as 1, 2, 3 etc of a building, 4 a telephone pillar, 5 a tree etc around the plane table got bisected and radial lines are drawn showing their directions. The table is then shifted to the station Y and get it set and after orienting by backsighting to station Z get it clamped. With alidade pivoted at y, same objects i.e., 1, 2, 3, 4, 5 etc. get bisected and rays are drawn. The intersection of the respective rays provides the plotted positions of the respective details. The plotted positions of 1,2, 3 are then	explanation, procedure with figure explanation, procedure with figure	3.5 marks	

	joined to represent the building corner. Telephone pillar and tree are represented by their conventional symbols. In this method, the plotting of plane table stations are to be carried out accurately. Checking is important and thus done by taking third sight from another station. The intersection method is suitable when distances of objects are large or cannot be measured properly. Thus, this method is preferred in small scale survey and for mountainous regions. Traversing  Let us consider the stations P, Q, R and S, which are to plotted by method of traversing. Stations are to be chosen in such a way that adjoining stations are visible. First, the plane table is to be set at station P and then plotted as p. The orientation of the table and scale of plotting should be such that all other stations will be accommodated within the boundary of the sheet. With the alidade pivoted at p, draw the rays to Q and S. Distances PQ and PS are measured and plotted on the respective rays, pq and ps respectively. The plane table is then shifted to station Q, get it set and then oriented by back sighting to station P. With the alidade pivoted at q, draw a ray to R. Distance QR is measured and plotted on the ray as qr. In this way, plane table is shifted to stations R and S and corresponding rays are drawn to obtain the plotting of the traverse pqrs.	explanation, procedure with figure explanation, procedure with figure	3.5 marks	7 marks
IV (a)	For first 1500 metres : Average error = e = 0.05 m $L' = 20.05$ m $L1 = \frac{20.05}{20} \times 1500 = 1503.75$ m For next 1400 m, average error = 0.14 m $L' = 20 + 0.14 = 20.14$ m $L2 = \frac{20.14}{20} \times 1400 = 1409.8$m Total length = L1 + L2 = 2913.55 m	calculating L1 Calculating L2 L1 + L2	3 marks 3 marks 1 mark	7 marks

IV (b)	Cross staff : the simplest instrument used to set out a right angle is called a cross staff. It consists of either a frame or a box with two pairs of vertical slits and is mounted on a pole shod for fixing in the ground		2 marks	
	Open cross staff : it is provided with two pairs of vertical slits giving two lines of sights at right angles to each other. The cross staff is set up at a point on the line from which the right angle is to run, and is then turned until one line of sight passes through the ranging pole at the end of the survey line. The line of sight through other two vanes will be a line at right angles to the survey line and a ranging rod may be established in that direction. It is held vertically on the chain line at a point where the foot of the offset is likely to occur. It is then turned so that one line of sight passes through the ranging rod fixed at the end of the survey line. Looking through the other pair of slits, it is seen if the point to which the offset is to be taken is bisected. If not, the cross staff is moved backward or forward till the line of sight also passes through the point	description	2 marks	
	French cross staff : It consists of a hollow octagonal box. Vertical sighting slits are cut in the middle of each face, such that the lines between the centres of opposite slits make angles of 45^0 with each other. It is possible to set out angles of either 45^0 or 90^0 with this instrument	description	2 marks	
	Adjustable cross staff It consists of two cylinders of equal diameter placed one on the top of other. Both are provided with sighting slits. The upper box carries a Vernier and can be rotated relatively to the lower by a circular rack and pinion arrangement actuated by a milled headed screw. The lower box is graduated to degrees and subdivisions. It is possible to set out any angle with this instrument	description	2 marks	8 marks
V (a)	Local attraction is used to denote any influence which prevents the needle from pointing to the magnetic North in a given locality. Some of the sources of local attraction are magnetite in the ground, wire carrying electric current, steel structures, rails, under ground pipes, keys, chains, steel tapes etc which may be lying on the ground nearby.	definition	3 marks	
	Detection : local attraction at a particular place can be detected by observing the fore bearing and back bearing of each line and finding its difference. If the difference between fore and back bearing is 180^0, it may be taken that both the stations are free from local attraction, provided there are no observational and instrumental errors. If the difference is other than 180, the fore bearing should be measured again to find out whether the discrepancy is due to avoidable attraction from the articles on person, chains, tapes etc. if the difference still remains, local attraction exists at one or both the stations.	detection	4 marks	7 marks

V (b)

Line	Observed bearing	Correction	Corrected bearing		Remarks		
AB	$45^0 45'$	0 at A	$45^0 45'$		Stations B and C are affected by local attraction	1x 8 = 8	8 marks
BA	$226^0 10'$	-25' at B	$226^0 45'$				
BC	$96^0 55'$	-25' at B	$96^0 30'$				
CB	$277^0 5'$	-35' at C	$276^0 30'$				
CD	$29^0 45'$	-35' at C	$29^0 10'$				
DC	$209^0 10'$	0 at D	$209^0 10'$				
DE	$324^0 48'$	0 at D	$324^0 48'$				
ED	$144^0 48'$	0 at E	$144^0 48'$				

Vi (a)

Line	**F.B**
AB	40^0
BC	70^0
CD	210^0
DA	280^0

$<A = 60^0$, $< B = 150^0$, $<C = 40^0$, $<D = 110^0$

Sum = 360^0, no correction

Correct value of each angle 2 marks — 2 x 4 = 8 — 8marks

Vi (b)

Types of meridians :

1. True meridian
2. Magnetic meridian
3. Arbitrary meridian

Definition of three — 7 marks — 7 marks

Vii (a)

Temporary adjustments of dumpy level

1. Setting up
2. Levelling up
3. Elimination of parallax
   a) Focusing the eye piece
   b) Focusing the objective

Three steps with procedure and figure — 7 marks — 7 marks

VII (b)	Station	B.S	I.S	F.S	Rise	fall	R.L	Remarks	Tabulation : Reduced levels Arithmetic check	2 marks 4 marks 2 marks	8 marks
	1	2.228					432.384	BM			
	2	1.606			0.622		433.006				
	3	2.090		0.988	0.618		433.624	T.P.I			
	4		2.864			0.774	432.850				
	5	0.602		1.262	1.602		434.452	T.P.2			
	6	1.044		1.982		1.380	433.072	T.P 3			
	7			2.684		1.640	431.432				
VIII (a)	1. Vertical axis: It is the centre line of axis of notation of the level. 2. Axis of level – tube: It is an imaginary line tangential to the longitudinal curve of the tube at its middle point. It is horizontal when the bubble is central. 3. Axis of telescope: It is the line joining the optical centre of the object glass & the centre of eye piece. 4. Line of collimation or line of sight: It is the line joining the intersection of cross hairs & optical centre of the object glass. a. Different axes Relation among fundamental lines 1. Axis of the level tube is perpendicular to the Vertical axis 2.Horizontal cross hair should lie in a plane perpendicular to the Vertical axis, so that it will lie in a Horizontal plane when the instrument is properly leveled. 3.The Line of sight is parallel to the axis of the level tube								Name of axes with definition : Relations :	4 marks 3 marks	7marks

VIII (b)

Station	B.S	I.S	F.S	Rise	fall	R.L	Remarks
1	0.602					192.122	BM
2		1.234			0.632	191.490	
3		1.860			0.626	190.864	
4	0.238		2.574		0.714	190.150	T.P
5		0.914			0.676	189.474	
6		1.936			1.022	188.452	
7	0.568		2.872		0.936	187.516	T.P
8		1.824			1.256	186.260	
9			2.722		0.898	185.362	

Tabulation 2 marks

Reduced levels 4 marks

Arithmetic check 1 mark

Gradient 1 mark

8 marks

Gradient = 1 in 23.82

IX. a

Profile levelling

definition, procedure with figure 4 marks

Profile leveling is a method of surveying that has been carried out along the central line of a track of land on which a linear engineering work is to be constructed/ laid. The operations involved in determining the elevation of ground surface at small spatial interval along a line is called profile leveling. The route along which a profile is run may be single straight line, as in case of a short sidewalk; a broken line, as in the case of a transmission line or sewer; or a series of straight lines connected by curves, as in case of a railroad, highway or canal.

The line along which the profile is to be run is to be marked on the ground before taking any observation. Stakes are usually set at some regular interval which depends on the topography, accuracy required, nature of work, scale of plotting etc. It is usually taken to be 10 meter. In addition, stakes are placed at locations where marked changes in slope occur; a change in direction occur; at critical points like culverts, bridges and other features crossing the alignment. The beginning station of profile leveling is termed as 0+00. Points at multiples of 100m from this point are termed as full stations. Intermediate points are designated as pluses

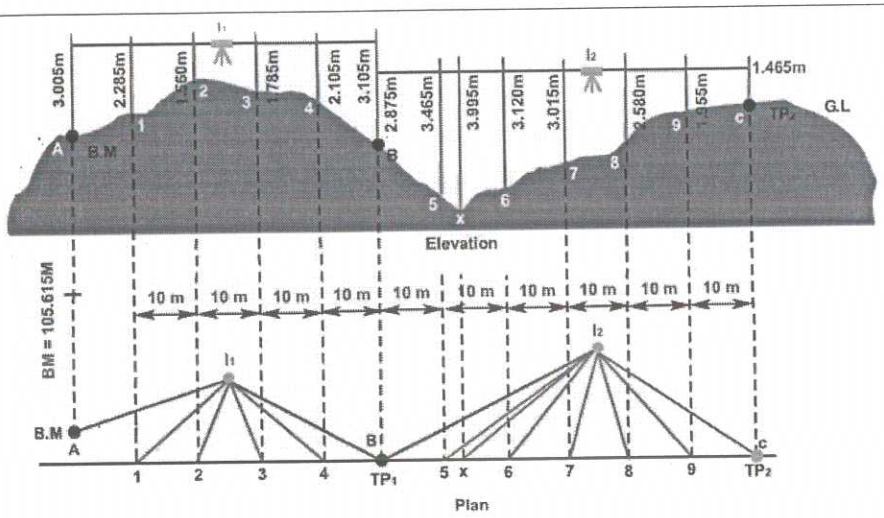


Figure 14.1 Profile Levelling

Cross sectioning

In many projects, terrain information transverse to the longitudinal section (through profile leveling) is also required such as for highways, railways, canals etc. In those cases, surveying is carried out at right angle to the central line, generally, at regular interval is being carried out and is termed as cross- sectioning. If, for any reason, a cross-section is run in any other direction, the angle with the centre line is required to be noted. The observations are then recorded as being to the left or right of the centre line.

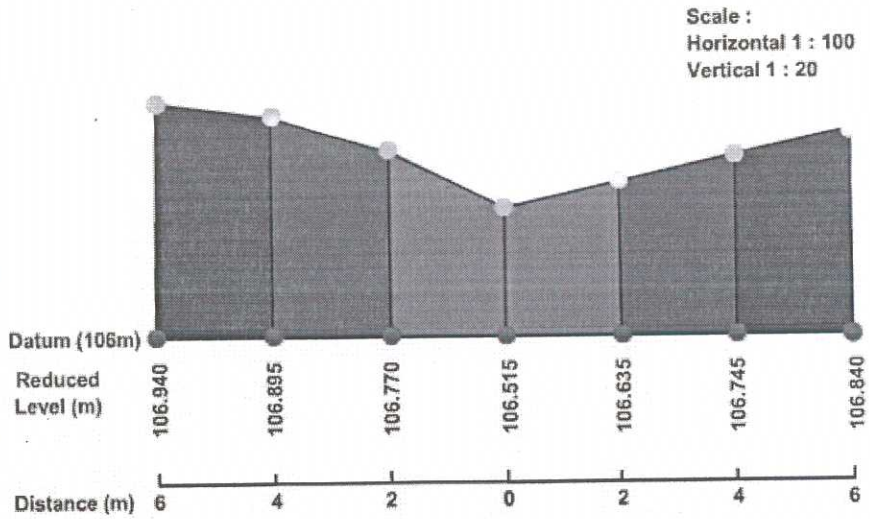
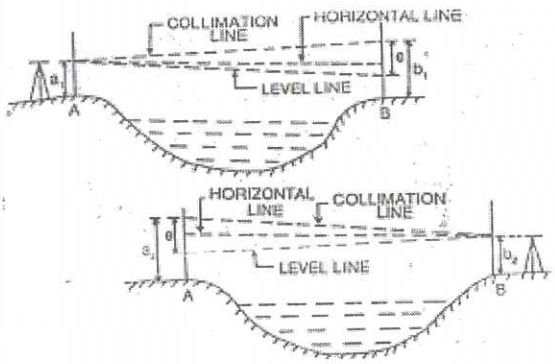


Figure 14.3 Cross-section along Stake 4 (0 + 40m)

IX. b

when it is necessary to carry levelling across a river or any obstacle requiring a long sight between two points so situated that no place for the level can be found from which the lengths of foresight and backsight will be even approximately equal, reciprocal levelling must be used to obtain accuracy and to eliminate 1) error in instrument adjustment 2) combined effect of earth's curvature and the refraction of the atmosphere and 3) variations in the average refraction

definition, procedure with figure	4 marks	
definition, procedure with figure	4 marks	8 marks
Definition	2 marks	
procedure	2 marks	
Figure	2 marks	7 marks
Equation	1 mark	

	Figure  Equation : H = ½ [(ha-hb) +(ha' - hb')]			
X. a	1. Two contour lines of different elevations cannot cross each other. Contour lines of different elevations can intersect only in the case of an overhanging cliff. 2. contour lines of different elevations can unite to form one line only in the case of a vertical cliff. 3. contour lines close together indicate steep slope. They indicate a gentle slope if they are far apart. If they are equally spaced, uniform slope is indicated. 4. A contour line passing through any point is perpendicular to the line of steepest slope at that point. 5. A closed contour line with one or more higher ones inside it represents a hill. Similarly, a closed contour line with one or more lower ones inside it indicates a depression with out an outlet. 6. Two contour lines having the same elevation cannot unite and continue as one line. 7. A contour line must close up on itself, though not necessarily within the limits of the map. 8. Contour lines cross a watershed or ridge line at right angles 9. Contour lines cross a valley line at right angles.	1 mark for each characteristic	1 x 7	7 marks
X. b	Indirect methods of contouring 1. By squares This method is used when the area to be surveyed is small and the ground is not much undulating. The area to be surveyed is divided into a number of squares. The size of square vary from 5 to 20 m depending up on the nature of the contour and contour interval. The elevations of the corners of the squares are then determined by means of a level and a staff. The			

	contour lines may then be drawn using interpolation. It is not necessary that the squares may be of same size. 2. By cross sections In this method, cross sections are run transverse to the centre line of a road, railway or canal etc. the method is most suited for railway route surveys. The spacing of the cross section depends up on the character of the terrain, the contour interval and the purpose of the survey. The cross sections should be more closely spaced where the contours curve abruptly. The cross section and the points can then be plotted and the elevation of each point is marked. The contour lines are interpolated on the assumption that there is uniform slope between two points on two adjacent contours. 3. By tacheometric method In case of a hilly terrain, the tacheometric method may be used. The tacheometer may be set on a point from which greater control can be obtained. Radial lines can then be set making different angles with either the magnetic meridian or with the first radial line. On each radial line, readings may be taken on levelling staff kept at different points. The point must be so chosen that approximate vertical difference in elevation between two consecutive points is less than the contour interval. Thus, on the same radial line, the horizontal equivalent will be smaller for those two points the vertical difference in elevation of which is greater and vice versa. To survey an area connected by a series of hillocks, a tacheometric traverse may be run. At each traverse station, several radial lines may be run in various directions as required, the horizontal control being entirely obtained by the tacheometer. The traverse, the radial lines and the points can then be plotted. The elevation of each point is calculated by tacheometric formula and the contours can be interpolated as usual.	Any 2 methods with explanation and figure	4 x 2 =8 marks	8 marks