(19) Q 1

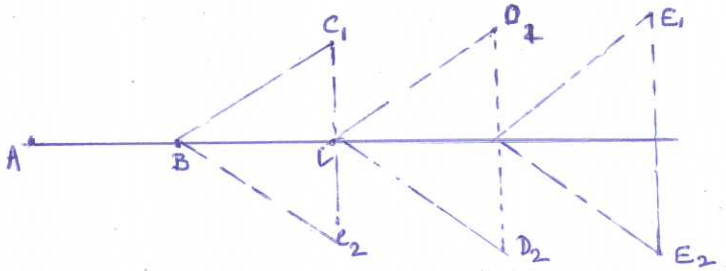
Scoring Indicators

Code : T6D(15)3012 Version: 02(Q)

Qn. No.	Scoring Indicators	Split score	Total score
I	PART A		
1	The Vertical axis, The axis of the plate level, The Line of Collimation, Trunnion axis (Horizontal axis), The altitude level bubble line.	Any 4 each $\frac{1}{2}$ mark = 2	2
2.	Used when angular measurements are more precise than linear measurements.		
	Error in latitude (or departure) of any line = $\frac{\text{Total error in latitude (or departure)} \times \text{numerical value of } l(\text{or } d)}{\text{Arithmetic sum of all latitudes (or departures)}}$	2	
3	In Tacheometry, the horizontal distance between axis and shaft is $D = Ks + C$, the constant $K = \frac{f}{i}$ is known as multiplying Constant and $(f+d) = C$ is known as additive Constant.	2	
4	The ordinate joining the mid point of the curve and long chord is the mid ordinate.	2	
5.	Laser transmission and receiving. Laser is emitted and it strikes a target usually prism and it is received and interpeted as distance.	2	
			10

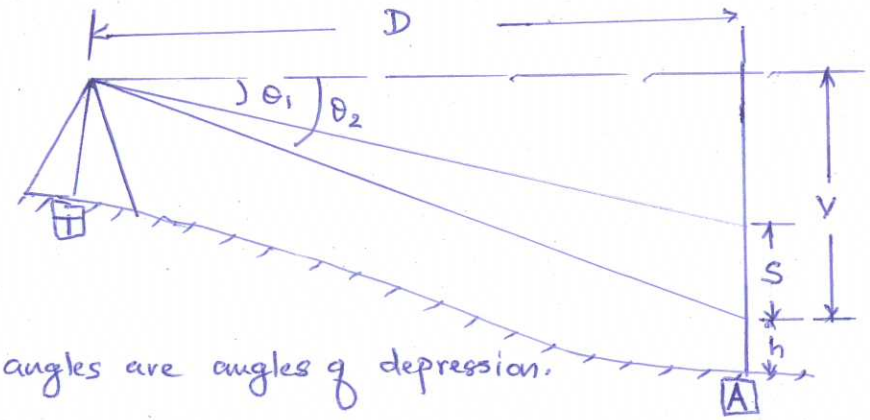
Scoring Indicators

Code : TED(15)3012 **Version:** 8

Qn. No.	Scoring Indicators	Split score	Total score
	PART- B		
II 3 (a)	The Latitude of a line may be defined as the distance measured parallel to the meridian, ie N-S. direction. The projection towards north is positive and South is negative. They are northing and southing respectively.	2	
	The departure of a line may be defined as the distance measured ~~parallel to~~ perpendicular to the meridian. positive departure is Easting and negative departure is Westing.	2	
	latitude = $l \cos\theta$, Departure = $l \sin\theta$. where 'θ' is the Reduced bearing.	1 1	6
10		1	
	1 Set up the instrument with face left over B. make the Temperory adjustments. Sight Station A, using lower clamp and bisect A accurately using lower tangent Screw.	1	
	2. Plunge the telescope and establish a point c in line with AB.	1	
	3. Unclamp the lower plate and Swing the telescope about its Vertical axis and take a back sight on A.	1	

Scoring Indicators

Code : TED(15)3012 **Version:** Q

Qn. No.	Scoring Indicators	Split score	Total score
	Clamp the lower screws. The telescope is in inverted position.		
	4. plunge the telescope. Set a point C_2 in line with AB. The point C_2 will not coincide with C_1 if the instrument is not in adjustment. C_1 and C_2 will be on opposite side of BC.	1	
	5. measure the distance C_1C_2 accurately and establish a point 'c' exactly midway between C_1C_2.	1	6
5.			
	Both angles are angles of depression.	2	
	$V = D\tan\theta_2$		
	$V - S = D\tan\theta_1$ then $S = D(\tan\theta_2 - \tan\theta_1)$	1	
	or $D = \frac{S}{\tan\theta_2 - \tan\theta_1}$	1	
	Vertical distance $V = D\tan\theta_2 = \frac{S\tan\theta_2}{\tan\theta_2 - \tan\theta_1}$	1	
	Elevation of Station A = HI − V − h.	1	6

Scoring Indicators

Code : TED (15) 3012 **Version:** 6

Qn. No.	Scoring Indicators	Split score	Total score
II			
2	a) Rotating the telescope of a theodolite by 180° with respect to the trunnion axis in a vertical plane is transiting b) Rotating the telescope of a theodolite by 360° with respect to the Vertical axis in a horizontal plane is Swinging. c) When the Vertical circle of a theodolite is towards the left of an observor, while taking readings it is face left condition. It is the normal position of a theodolite d) When the Vertical circle is towards the right of an observor, while taking readings it is face right-observations. It is the inverted condition of a theodolite	1½ each	6
4	Repetition method is the process of measuring an angle repeatedly a number of times and finding the mean of the angle by dividing the final reading with the number of repetitions made.	3	

Scoring Indicators

Code : TED(15) 3012 **Version:** 02

Qn. No.	Scoring Indicators	Split score	Total score
	The errors eliminated are errors due to eccentricity of Verniers errors due to improper line of Collimation errors due to improper graduations errors due to improper by Section.	any 3 3 marks	6

Scoring Indicators

Code : TED(15) 3012 **Version:** Q

Qn. No.	Scoring Indicators	Split score	Total score
✱	Simple Curve – The curve with a single curved arc having a constant radius all through is a simple curve. It is tangential to two straights at the ends of the curve.	1½	
	Compound Curve – A curve which consists of two or more arcs of different circles with different radii having different centres lying on the same side of a common tangent	1½	
	Reverse curve – A curve which consists of two ore more arcs of different radii having different centres on opposite sides of ~~the curve~~ a common tangent is a reverse curve.	1½	
	Transition Curve – It is an easement curve introduced between two simple curves. The radius of a transition curve gradually change from a finite value to infinite value.	1½	6
6.	Length of a Curve = $\frac{\pi R \phi}{180}$ where ϕ in degrees.	1	
	Tangent Length = $R \tan \phi/2$	1	
	Length of long chord = $2R \sin \phi/2$.	1	
	External distance (Apex distance) = $R(\sec \phi/2 - 1)$	1	
	Mid ordinate = $R(1 - \cos \phi/2)$ R = Radius of the curve.	1	
	$D^\circ = 1718.9/R$	1	6

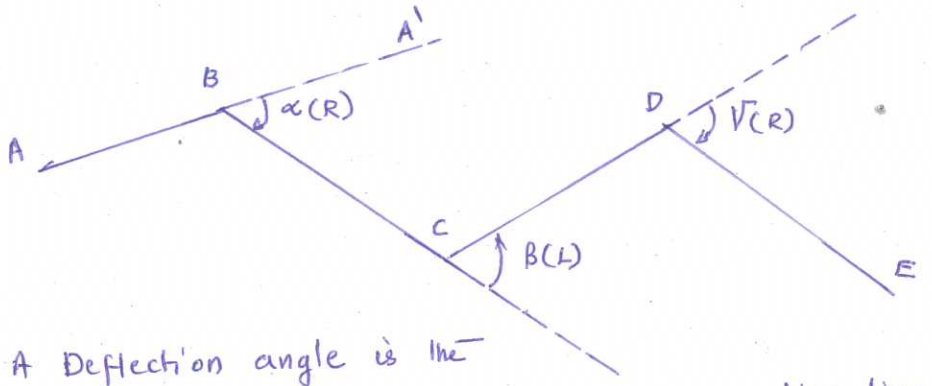
Scoring Indicators

Code : TED(15) 3012 **Version:** Q

Qn. No.	Scoring Indicators	Split score	Total score
7	Equal area projection - This projection preserve area. All thematic maps should use an equal area projection. Cylindrical and Sinusoidal Equal area method is the Common projection method used.	2	
	Conformal projections preserve angles and are useful for navigational charts and weather maps. while maping Small areas are preserved while large areas distorted.		
	Lambert Conformal Conic projection and Mercator projection are Common used conformal projections.	2	
	Equidistant - preserve distances, but not all distances can be preserved. There will be some type of distortions. All points on the map are at the correct azimuth from the center point.	2	6
7.	1. measure electronically angles and distances		
	2. Adjust the measurement with respect to pressure and temperature		
	3. To do trigonometrical levelling work.		
	4. To eliminate defects due to curvature and refraction.		
	5. To change inclined length to horizontal length.	any 6 1 mark each.	
	6. To find Vertical height		
	7. To measure area of a traverse		
	8 To mark the centre line for residential building.		6

Scoring Indicators

Code : TED(15) 3012 **Version:** Q

Qn. No.	Scoring Indicators	Split score	Total score
III a)	PART-C  A Deflection angle is the angle made by the prolongation of the preceding line with the following line. When measured clockwise it is Right-defln. angle.	2 1	
	1. Set-up and level the theodolite over B. Set the Verniers to read zero. Take a back sight on A and clamp both plates.	1	
	2. Transit the telescope. It is in line with AB to AA'. unclamp the upper and swing the telescope till C is bisected. Read both Verniers. The mean gives the deflection angle at B (α).	1	
	3. Repeat the procedure for face left condition by transiting the telescope.	1	
	4. The measured deflection angle is doubled. One half of Value gives the actual deflection angle.	1	7
b)	Temporary adjustments – Setting up, centering, Levelling up focussing the eye piece, Focussing the objective.	3	
	Permanent adjustments –		
	1 making the plate level axis perpendicular to the Vertical axis		
	2 making the Vertical cross hairs of the diaphragm perpendicular to the horizontal axis.		

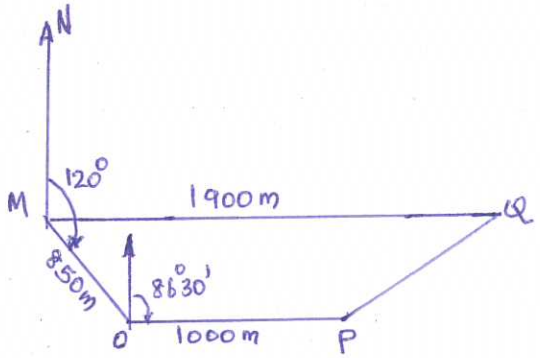
Scoring Indicators

Code : TED(15) 3012 **Version:** Q

Qn. No.	Scoring Indicators	Split score	Total score
	To make the line of sight perpendicular to the horizontal axis To make the Vertical axis perpendicular to the horizontal axis Adjustment of Vertical Circle Index.	5	8
IV a)	Set up the instrument on the firm level ground and level up accurately at a point 'O'	1	
	Select a Station point P about 30m away from 'O'. Drive sight 'P' with the telescope in normal position. Clamp both the plates.	1	
	By means of lower tangent Screw bring the Vertical cross hair into exact coincidance with P.	1	
	Transit the theodolite and Set another point 'Q' on the line in oppossite direction at a distance of about 30m.		
	Loose the lower clamp and Swing the instrument in horizontal plane and sight P again.	1	
	clamp the lower plate and bisect 'P' exactly using lower tangent Screw.		
	Transit the telescope. if the telescope points 'Q' exactly then the line of Sight is perpendicular to the horizontal axis.	1	
	If not Q' is bisected.		
	If the line of sight and horizontal axis are not truely perpendicular and differ by 'e', the resultant error in the instrument be 4e.	2	
	Loosen the horizontal Capstan Screw on the cross hair ring and move the cross hairs by $\frac{1}{4}$ QQ'	2	9

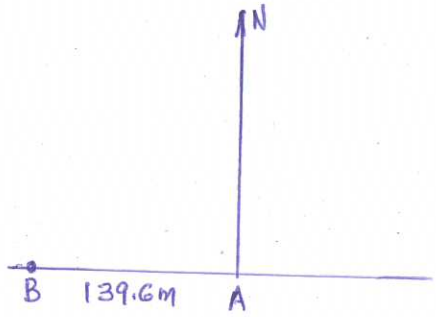
Scoring Indicators

Code : TED(15)3012 **Version:** Q

Qn. No.	Scoring Indicators	Split score	Total score
b)	Least count = $\frac{\text{Value of Smallest division on the main Scale}}{\text{Total number of divisions on the Vernier}}$	1	
	In case of a Vernier theodolite, the main scale is divided into 6 degrees and a degree is further divided into 3 equal parts so that the value of the smallest division on main scale is $(\frac{1}{3})^\circ$ = 20 minutes.	2	
	The total number of divisions on Vernier = 60		
	$\therefore$ Least count = $20'/60 = \frac{20 \times 60''}{60}$ = ~~20 seconds~~.	2	6
	= $\frac{1}{3}$ minute = 20 seconds.		
V	UNIT – II		
		2	
	Bearing of the line MN = 360°		
	Line MQ is set right angles to MN		
	let 'l' be the length of PQ and θ its bearing.	2	
	Since MOPQ is a closed traverse $\Sigma L = 0$, $\Sigma D = 0$.		
	$\Sigma L = 1900 \cos 90 - 850 \cos 60 + 1000 \cos 86^\circ 30' + l \cos\theta = 0$	2	
	$l \cos\theta = 364$m.		
	$\Sigma D = 1900 \sin 90 + 850 \sin 60 + 1000 \sin 86^\circ 30' + l \sin\theta = 0$.	2	
	$l \sin\theta = 3634$ m $\quad \therefore \tan\theta = 9.98$		

Scoring Indicators

Code : TED(15) 3012 Version: 3002 Q

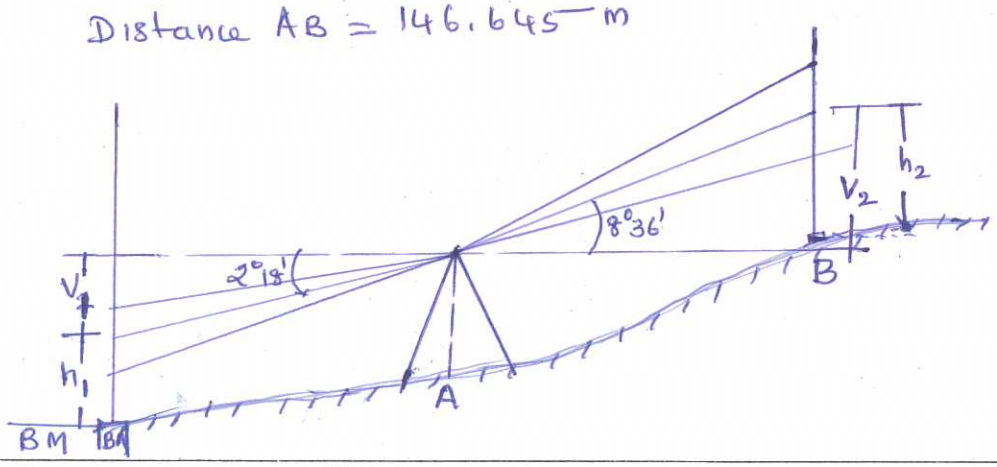
Qn. No.	Scoring Indicators	Split score	Total score
	$\theta = 84^\circ 16'$ WCB of line PQ = $84^\circ 16'$ Length of PQ = $\frac{3634}{\sin 84^\circ 16'} = 3652$ m	2	10
b)		1 2	
	Latitude = $139.6 \times \cos 90 = 0$ Departure = $-139.6 \times \sin 90 = -139.6 = 139.6$ due West.	2	5
	OR		
VI a)	$\Sigma L = 0$ $300.75 + 200.25 - 299 - 200 = +2 = e_y$		
	$\Sigma D = 0$. $299.25 + 199.75 - 200.50 - 300.50 = -2 = e_x$	1	
	closing error = $\sqrt{2^2 + -2^2} = 2.828$ m.	1	
	$\tan\theta = 1$ (as the line lies in 4th quadrant) $\theta = 45$ (or -45)		
	$\therefore$ WCB = $360 - 45 = 315^\circ$.	1	
	Adjustment by transit rule		
	Arithmetic Sum of latitude = $300.75 + 200.25 + 299 + 200.00$ $= 1000$.	1	

Code : TED(15) 3012 Version: 2

Qn. No.	Scoring Indicators	Split score	Total score
	Correction to latitude of $AB = \frac{200.25}{1000} \times 2 = 0.40$	1½	
	Correction = $^{-}0.40$ as error is +ve.		
	Correction to departure of $AB = \frac{299.25}{1000} \times 2 = 0.60$	1½	
	Correction = $^{+}0.60$ as error is -ve		
	$\therefore$ Corrected latitude of $AB = 200.25^{-} - 0.40 = 199.85^{-}$	1	
	Corrected departure of $AB = 299.25^{-} + 0.60 = 299.85^{-}$	1	
	Independant Co-ordinates of A = (100, 100)		
	Independant Co-ordinates of B = $100 + 299.85 = 399.85$ (x)	1	10
	and $100 + 199.85^{-} = 299.85^{-}$ (y)		
VI b)	0 0 634.8 1068.4 0 0 893.8 728.8 699.3 0		
	$\frac{1}{2}[(0 \times 893.8) + (0 \times 728.8) + (634.8 \times 699.3) + (1068.4 \times 0) - (0 \times 0) + (893.8 \times 634.8) - (728.8 \times 1068.4) - (699.3 \times 0)]$	5	5
	$= 116324.98\ m^2$		

Scoring Indicators

Code : TED(15) 3012 **Version:** 02

Qn. No.	Scoring Indicators	Split score	Total score
VII			
a)	$k=100$, $c=0$, RL of BM $=100.00$		
	When the staff is held Vertical		
	$D = ks\cos^2\theta + c\cos\theta$ and $V = ks\frac{\sin 2\theta}{2} + c\sin\theta$.		
	$c\sin\theta = 0$, $c\cos\theta = 0$.	1	
	In the first observation $s = 2.450 - 1.500 = 0.95$		
	$\theta = -2^\circ 18'$		
	$V_1 = 100 \times 0.95 \frac{\sin(2\times 2^\circ 18')}{2} = 3.8094$ m	2	
	In the second observation, $s = 2.250 - 0.750 = 1.50$		
	$V_2 = 100 \times \frac{\sin(2\times 8^\circ 36')}{2} \times 1.50 = 22.178$ m	2	
	$D_2 = ks\cos^2\theta = 100\times 1.5 \times \cos^2 8^\circ 36' = 146.645$	1	
	RL of the instrument axis = RL of the BM + $h_1 + V_1$		
	$= 100 + 1.800 + 3.8094 = 105.6094$	1	
	RL of B = RL of instrument axis + $V_2 - h_2$		
	$= 105.6094 + 22.178 - 1.50 = 126.2874$	1	
	Distance AB = 146.645 m		
		2	10

Qn. No.	Scoring Indicators	Split score	Total score
VII b)	Let O' be the instrument Station and A the Staff Station.		
	$V = 3000 \tan 2^\circ 30' = 130.98\,m$		
	RLof Staff Station = RLof O + HI + V − 3 =		
	$= 200 + 130.98 - 3 = 327.98\,m$.	5	5
VIII	Staff Station A.		
	Staff intercept $S_1 = 2.050 - 0.95 = 1.100\,m$.		
	$\theta_1 = +10^\circ 20'$	1	
	Central reading = 1.500 , C = 0	1	
	Horizontal Distance = $KS\cos^2\theta + C\cos\theta$.		
	$= 100 S \cos^2\theta = 100 \times 1.1 \times \cos^2 10^\circ 20'$	1	
	$D_1 = 106.46\,m$	1	
	$V_1 = KS\frac{\sin 2\theta}{2} + C\sin\theta$.	1	
	$V_1 = 100 \times 1.1 \times \frac{\sin 20^\circ 40'}{2} = 19.41\,m$		
	Staff Station B		
	$S_2 = 3.150 - 0.845 = 2.305$	1	
	$\theta_2 = -5^\circ 30'$		
	$D_2 = 100 \times 2.305 \cos^2 5^\circ 30' =$	1	
	$D_2 = 228.38$		
	$V_2 = 100 \times 2.305 \times \frac{\sin 11^\circ}{2} = 21.99\,m$.	1	

Code : TED(15) 3012 Version: Q

Qn. No.	Scoring Indicators	Split score	Total score

Let HI be the RL of the height of the instrument.

∴ Level at A = $HI + V_1 - r_1 = HI + 19.41 - 1.5$ 1

$= HI + 17.91$

Level at B = $HI - 21.99 - 2.100 = HI - 24.09$ 1

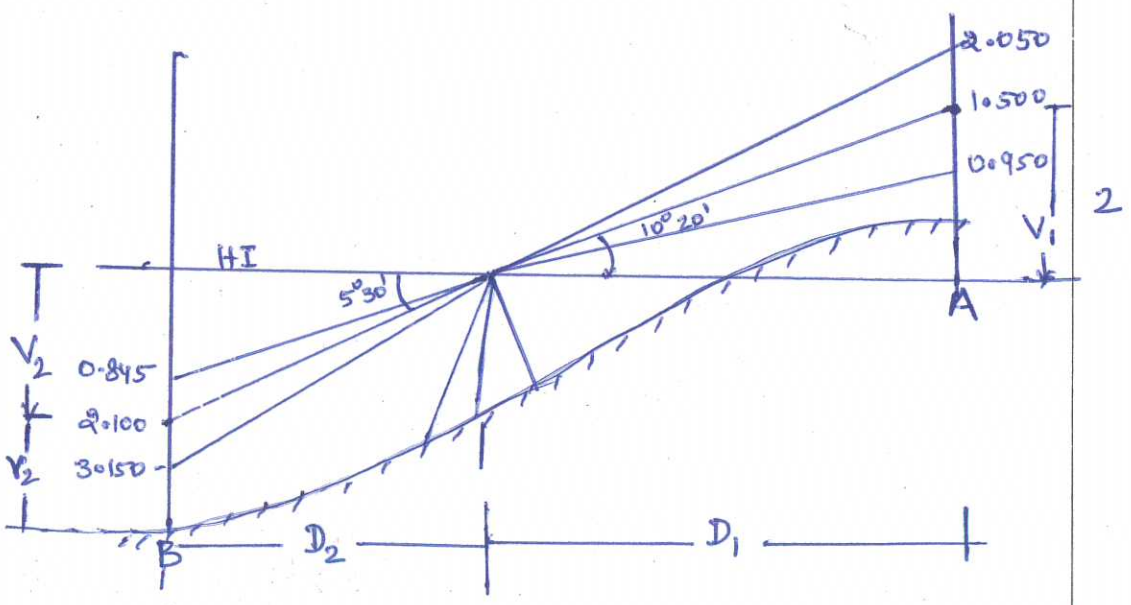
∴ Fall from A to B = $(HI + 17.91) - (HI - 24.09)$ 1

$= 42.00$

$$\text{Gradient} = \frac{\text{Difference in level}}{\text{Total distance}}$$

$$= \frac{42.0}{106.46 + 228.38} = \frac{42}{334.84}$$ 1

$$\text{Gradient Ratio} = \frac{1}{7.97} = 1 \text{ in } 7.97$$ 1

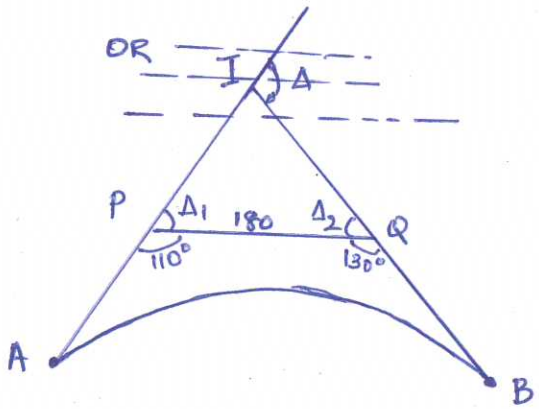


Code : TED(15) 3012 Version: Q

Qn. No.	Scoring Indicators	Split score	Total score
	UNIT IV		
IX a)	Setup the theodolite at the point of Commencement of the Curve. This point can be arrived by knowing the length of tangent and point of intersection. 2. Take. Consider the chainage of the point of Commencement and calculate the length of the ~~first~~ sub-chord to have continous chainage. 3 calculate the deflection angles for the first Sub chord, normal chord and the last sub chord. 4. Centre the theodolite over the point of Commencement and level it. 5. Mark the Vernier to read zero degree, minutes and seconds Using the upper clamp and tangent Screw. clamp the upper circle. 6. With the help of the lower clamp and tangent screw Sight the point of intersection of the curve I. 7. Unclamp the upper plate and set the Vernier to read deflection angle $\Delta_1 (\delta_1)$ for the first Sub chord C_1. ($\Delta_1 = \delta_1 = 1718.9 \frac{C_1}{R}$). Now the line of Sight is along the first Sub chord. 8. With T_1 as Centre and C_1 as radius, Swing chain or tape and fix an arrow in the line of Sight.	1 mark each for steps upto 10	

Scoring Indicators

Code : TED(15)3012 Version: Q

Qn. No.	Scoring Indicators	Split score	Total score
	9 Set the Vernier to read the deflection angle Δ_2 for the first normal chord		
	10 keeping one end of the chain at the point previously fixed on the curve, swing the chain until other end of the chain falls in the line of sight of the theodolite. fix this point		10
	11 This procedure is repeated till the point of tangency is located.		
IX	b) 1. Antennas with preamplifier.		
	2. RF Section with Signal identification and processing		
	3. Microprocessor for receiver control data sampling and processing	Each 1 mark. Any 5	
	4 precision oscillator		
	5 Power Supply		5
	6 user interface, command & display pannel		
X	a) 	2	

Scoring Indicators

Code : TED(15) 3012 Version: 0

Qn. No.	Scoring Indicators	Split score	Total score
	$\Delta_1 = 180^\circ - 110^\circ = 70^\circ$, $\Delta_2 = 180 - 130 = 50^\circ$		
	$\therefore \Delta = 70 + 50 = 120^\circ$	1	
	From Δ IPQ $\frac{IP}{\sin\Delta_2} = \frac{IQ}{\sin\Delta_1} = \frac{PQ}{\sin(180-\Delta)}$	1	
	$IP = \frac{PQ}{\sin(180-\Delta)} \times \sin\Delta_2 = \frac{180 \times \sin 50}{\sin 60} = 159.22m$	1	
	$IQ = \frac{180 \times \sin 70}{\sin 60} = 195.31m$	1	
	Tangent length = $IA = IB = R \tan \Delta/2$		
	$= 500 \times \tan \frac{120}{2} = 866.02$ m.	1	
	$AP = AI - IP = 866.02 - 159.22 = 706.80$ m.		
	$BQ = 866.02 - 195.31 = 670.71$ m.		
	Chainage of point A = Chainage of P − 706.8		
	$= 2500 - 706.8 = 1793.20$	1	
	Length of curve = $\frac{\pi R \Delta}{180} = \frac{\pi \times 500 \times 120}{180} = 1047.19$	1	
	$= 1047.19$ m.		
	Chainage of B = Chainage of A + 1047.19	1	10
	$= 1793.20 + 1047.19 = 2840.39$ m		
	All other datas can be selected as per requirement.		

Scoring Indicators

Code : TED(15)3012 Version: Q

Qn. No.	Scoring Indicators	Split score	Total score
X b)	Distomat is a precise modern Electronic Distance measurement (EDM) instrument. The master Distomat at the main station produce and transmit-signals and the remote distomat- receives, monitor and reflect back the signal. It can measure Distance from 20m to 150 km.	2½	
	The most popular models are Distomat- D_1, Distomat D_1-55, Distomat D_1-3000 Distomat- D 10R 3002, Tachymet- TC-2000	2½	5