Advanced Surveying

Engineering

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Sec :- A

Paper :- Advanced Surveying Engineering

Q No 1 (a)

Tangent Meet at chainage = 7899

Deflection angle = 14°31'23"

Degree of Curve = 5°

Solution :- $D = 5^\circ$

$$R = \frac{5729.58}{D}$$

$$R = \frac{5729.58}{5^\circ} = \boxed{1145.91 \text{ ft}}$$

Tangent length $= BT_1 = BT_2$

$$\Rightarrow R \tan\left(\frac{\Phi}{2}\right)$$

$$\Rightarrow 1145.91 \times \tan\left(\frac{14^\circ 31' 23''}{2}\right)$$

$$= \boxed{142.96 \text{ ft}}$$

Length of Curve $L = \frac{\pi R \Phi}{180}$

$$\Rightarrow \frac{(3.14)(1145.91)(14^\circ 31' 23^\circ)}{180}$$

$$\boxed{L \Rightarrow 284.45 \text{ ft}}$$

Change of intersection point = 7899

Change of T_1 = 7899 − tangent length

$\Rightarrow$ 7899 − 142.96 ft

$$T_1 = 7756.04 \text{ ft}$$

Chainage of T_2 = T_1 + length of curve

$\Rightarrow$ 7756.04 + 284.45

$$T_2 \Rightarrow 8043.49$$

Length of Chord $= 2R\sin\left(\frac{\Phi}{2}\right)$

$= 2(1145.91)\sin\left(\frac{14°31'23''}{2}\right)$

245.7274 ft

Mid ordinate $= R\left(1-\cos\frac{\Phi}{2}\right)$

$\Rightarrow 1145.91\left(1-\cos\frac{14°31'23''}{2}\right)$

$\Rightarrow$ 8.81 ft

External distance $= R\left(\sec\left(\frac{\Phi}{2}\right)-1\right)$

$= 1145.91\left(\sec\frac{(14°31'23''}{2}\right)$

$\Rightarrow$ 8.88 ft

part — (b)

ID = 7888

7899 ÷ 1000 ⇒ 7.899

chainage(m)	offset	Simpson Multiplier	Product
0	7.899	1	7.899
30	7.899+3 ⇒ 10.899	4	43.596
60	7.899+4 ⇒ 11.899	2	23.798
90	7.899−2 ⇒ 5.899	4	23.596
120	7.899−4 = 3.899	2	7.798
150	7.899−3 ⇒ 4.899	1	4.899
		Σ =	111.586

$$\text{Area} = (h_1 - h_8)$$

$$= \frac{b}{3} \times (111.586)$$

$$= \frac{30}{3} \times (111.586)$$

$$\text{Area} = 1115.86\ m^2$$

Q NO2 (a)

Give data

Circular Radius = 7899 ~~7000~~

Assume value = 7000

$$R = 899m$$

Deflection angle = 20°40'0"

Solution

Chainage at point of intersection which we also assume = ID - 4000

$$\Rightarrow 7899 - 4000$$

$$\text{Chainage} = 3899m$$

peg interval = 20m

So, we can find tangent length

$$BT_1 = BT_2 = 899 \tan\left(\frac{20°40''}{2}\right)$$

$$= 163.916m$$

Length of curve

$$L = \frac{\pi R \phi}{180^\circ}$$

$$= \frac{3.14(899)(20^\circ 40')}{180}$$

$$L \Rightarrow 324.106\,m$$

$$T1 = 3889 - 163.916$$

$$T1 = 3735.084$$

Chainage at $T_2 = T_1 + L$

$$= 3735.084 + 324.106$$

$$\Rightarrow 4059.19$$

Value assumed = 3770

Now length of 1st sub chord =

$$3770 - 3735.084$$

$$C_1 = 34.916$$

Again length of last sub chord = Assume value 4030

T_2 − Assumed value

$4059.19 - 4030 = C_{15} = 29.19$

$C_2 = C_3 = C_4 \cdots C_{14} = 20m$

Now we can find No of chords

$$\text{No of chords} = \frac{\text{length of curve} - C_1}{\text{Interval}}$$

$$\Rightarrow \frac{324.106 - 34.916}{20}$$

$$\Rightarrow 14.78 \cong 15$$

$\therefore$ 15 chord

Now find, deflection Angle

$$\delta_1 = \frac{1718.9 \times C_1}{60R}$$

$$\Rightarrow \frac{1718.9 \times 34.916}{60 \times 899}$$

$$\delta_1 \Rightarrow 1^\circ 6' 45.59''$$

$$\delta_2 = \frac{1718.9 \times 20}{60 \times 899}$$

$$\boxed{\delta_2 \Rightarrow 0^\circ 38' 14.42''}$$

$$\delta_2 = \delta_3 = \delta_{14} = 0^\circ 38' 14.42''$$

$$\delta_{15} = \frac{1718.9 \times 29.19}{60 \times 899}$$

$$\boxed{\Rightarrow 0^\circ 55' 48.70}$$

Now total deflection (tangential) angle for the chord are

$D_1 = \delta_1 = 1^\circ 6' 45.59''$

$D_2 = D_1 + \delta_2 = 1^\circ 45' 0.01''$

$D_3 = D_2 + \delta_3 = 2^\circ 23' 14.43''$

$D_4 = D_3 + \delta_4 = 3^\circ 1' 28.85''$

$D_5 = D_4 + \delta_5 = 3^\circ 39' 43.27''$

$D_6 = D_5 + \delta_6 = 4^\circ 17' 57.69''$

$D_7 = D_6 + \delta_7 = 4^\circ 56' 12.11''$

$D_8 = D_7 + \delta_7 = 5°34'26.53''$

$D_9 = D_8 + \delta_9 = 6°12'40.95''$

$D_{10} = D_9 + \delta_{10} = 6°50'55.37''$

$D_{11} = D_{10} + \delta_{11} = 7°29'9.79''$

$D_{12} = D_{11} + \delta_{12} = 8°7'24.21''$

$D_{13} = D_{12} + \delta_{13} = 8°45'38.63''$

$D_{14} = D_{13} + \delta_{14} = 9°23'53.05''$

$D_{15} = D_{14} + \delta_{15} = 10°19'41.75''$

Q NO 3

Ans:-

Given data :-

$\Delta AKM = 130^\circ$

$\Delta KMC = 140^\circ$

1st arc radius $= (7899 - 300) = 7599_m$

2nd arc radius $= (7899 - 200) = 7699_m$

Chainage of intersection point

$(7899 - 400)_m$

$\Rightarrow$ 7499m

Required data :-

Tangent point = ?

Compound Curvature = ?

Solution :-

$\alpha = 180^\circ - 130^\circ \Rightarrow 50^\circ$

$\beta = 180^\circ + 40 \Rightarrow 40^\circ$

$\phi = \alpha + \beta = 90^\circ$

$$I = 180^\circ - \phi = 90^\circ$$

$$KT_I = kN = R_s \tan\frac{\alpha}{2}$$

$$\Rightarrow 7899 \tan(50/2)$$

$$\Rightarrow 3543.47\,m$$

Now

$$MN = MT_2 = R_L \tan(B/2)$$

$$\Rightarrow 7699 \tan 40/2$$

$$MN = MT2 = 2802.206\,m$$

Now we find KM

$$KM = MT_2 + kN \Rightarrow 3543.47 + 2802.206$$

$$\Rightarrow 6345.676\,m$$

Now for further Solution

Find $\triangle BkM$ by sin rule

$$\frac{Bk}{\sin B} = \frac{Mk}{\sin(I)}$$

Now

$$BK = \frac{MK \sin B}{\sin(I)}$$ (by Cross multiplication) (11)

$$\Rightarrow \frac{6345.676 \times \sin 40^\circ}{\sin 90^\circ}$$

$$BK \Rightarrow 4078.92 \text{ m}$$

$$BM = \frac{MK \sin \alpha}{\sin I} = \frac{6345.676 \times \sin 50^\circ}{\sin(90^\circ)}$$

$$BM \Rightarrow 4861.06 \text{ m}$$

Now find

$$Ts = KT_1 + BK \Rightarrow 3543.47 + 4078.92$$

$$Ts \Rightarrow 7622.39 \text{ m}$$

Now $TL = MT_2 + BM$

$$\Rightarrow 2802206 + 4861.06$$

$$TL \Rightarrow 7663.266 \text{ m}$$

Now

$$L_S = \frac{\pi R_S \alpha}{180} \Rightarrow \frac{3.14 \times 7599 \times 50}{180}$$

$$L_S = \boxed{6628.016 \text{ m}}$$

$$L_L \Rightarrow \frac{\pi R_L \beta}{180} \Rightarrow \frac{3.14 \times 7599 \times 40^\circ}{180^\circ}$$

$$L_L = \boxed{5372.19 \text{ m}}$$

Now we find Chainage

Chainage of intersection point minus T_S

$$T_1 = 7499 - 7622.39 \text{ m}$$

$$\boxed{T_1 \Rightarrow -123.39 \text{ m}}$$

plus $L_S \Rightarrow 123.39 + 6628.016$

$$T_1 \Rightarrow \boxed{6751.406 \text{ m}}$$

Chainage of T_2

$T_1 + 5377.07$

$\Rightarrow 6751.406 + 5377.07$

$T_2 = 12128.476\,m$