Mid Term Exams

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Sec:- B

Semester:- 4th

Deptt:- BE (Civil Engineering)

Subject:- Advanced Surveying Engg

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Q1.) Two tangents meet at a chainage of (ID) ft with a.) the deflection angle of 14°13'23" Degree of curve is 5°.

Calculate.

1.) Chainage at the beginning and end of the curve,
2.) Length of long chord.
3.) Mid ordinate and External distance?

Sol:-

Tangent meet at chainage = 7952 ft

Deflection Angle = 14°13'23"

Degree of curve = 5°

$R = 5729.58/D$

$R = 5729.58/5°$

$R = 1145.916$ ft

Tangent length = $BT_1 = BT_2 = R\tan\left(\frac{\phi}{2}\right)$

$BT_1 = BT_2 = 1145.916 \times \tan\left(\frac{14°13'23''}{2}\right)$

$BT_1 = BT_2 = 142.965 ft$

Length of curve

$L = \frac{\pi R \phi}{180°}$

$L = \frac{3.14 \times 1145.916 \times 14°13'23''}{180°}$

$L = 284.31 ft$

Chainage of Intersection Point = 7952 ft

Minus tangent length = -142.965ft

Chainage of T_1 = 7809.035 ft

plus tangent length = 284.31 ft

Chainge of T_2 = 8093.345 ft

(3)

Length of chord

$= 2R \sin\left(\frac{\phi}{2}\right)$

$= 2 \times 1145.916 \times \sin\left(\frac{14°13'23''}{2}\right)$

$= 283.731 \text{ ft}$

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

$= 1145.916\left(1 - \cos\left(\frac{14°13'23''}{2}\right)\right)$

$= 8.815 \text{ ft}$

External Distance

$= R\left(\sec\left(\frac{\phi}{2}\right) - 1\right)$

$= 1145.916\left(\sec\left(\frac{14°13'23''}{2}\right) - 1\right)$

$= 8.88 \text{ ft}$

b.) Sol:- Chainage = 30, 60, 90, 120, 150.

Offset No	offsets	Simpson Multiplier	Product
1.)	7.952	1	7.952
2.)	10.952	4	43.808
3.)	11.952	2	23.904
4.)	5.952	4	23.808
5.)	3.952	1	3.952
6.)	4.952		
			$\Sigma = 103.424$

$$\text{Area } (h_1 - h_5) = \frac{C_1}{3} \times 103.424$$

$$= \frac{30}{3} \times 103.424$$

$$= 1034.24 \text{ m}^2$$

$$\text{Area } (h_5 - h_6) = \frac{30}{2} (h_5 + h_6)$$

$$= \frac{30}{2} (3.952 + 4.952)$$

$$= 133.56 \text{ m}^2$$

$$\text{total Area} = 1034.24 + 133.56$$

$$= 1167.8 \text{ m}^2$$

Ans

Q2.) Sol:-

Circular Radius

$= 7952 - 7652$

$= 300m$

Deflection Angle

$= 20°40'$

point of Intersection

$= 7952 - 5000$

$= 2952$

Interval $= 20m$

Now,

$R = 300 \times 2 = 600$

$BT_1 - BT_2 = R \tan \frac{\phi}{2}$

$BT_1 = BT_2 = 600 \tan \frac{20°40'}{2}$

$BT_1 = BT_2 = 109.4m$

length of curve

$L = \frac{\pi R \phi}{180°}$

$$L = \frac{3.14 \times 600 \times 20°40'}{180°}$$

$$L = 216.31\ m$$

Chainage of point of intersection

$= 2952m$

Minus tangent $= -109.4m$

Chainage of $T_1 = 2842.6$

Plus $L = 216.31m$

Chainage of $T_2 = 3058.91$

Length of 1st Chord

$C_1 = 2860 - 2842.6$

$C_1 = 17.4$

$C_2 = C_3 = C_4 = C_5 = C_6 = C_7 = C_8 = C_9 = C_{10}$

$C_{11} = 3058.91 - 3040$

$C_{11} = 18.91$

By Deflection Method

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

$$\delta_1 = \frac{1718.9 \times 17.4}{60\ (600)}$$

$$\delta_1 = 0^\circ 49' 50.89''$$

$$\delta_2 = \frac{1718.9 \times 20}{60\ (600)}$$

$$\delta_2 = \frac{1718.9 \times 20}{60\ (600)}$$

$$\delta_2 = 0^\circ 57' 17.8''$$

$$\delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = \delta_8 = \delta_9 = \delta_{10}$$

$$\delta_{11} = \frac{1718.9 \times C_{11}}{60\ (600)}$$

$$\delta_{11} = \frac{1718.9 \times 18.91}{60\ (600)}$$

$$\delta_{11} = 0^\circ 54' 10.44''$$

Total deflection angle for the chord is,

$\Delta 1 = \delta 1 = 0°49'50.89''$

$\Delta 2 = \delta 1 - \delta 2 = 0°49'50.89'' + 0°57'17.8''$

$\Delta 2 = 1°47'8.69''$

$\Delta 3 = 2°44'26.49''$

$\Delta 4 = 3°41'44.29''$

$\Delta 5 = 4°39'2.09''$

$\Delta 6 = 5°36'19.89''$

$\Delta 7 = 6°33'37.69''$

$\Delta 8 = 7°30'55.49''$

$\Delta 9 = 8°28'13.29''$

$\Delta 10 = 9°25'31.09''$

$\Delta 11 = 10°22'48.89''$

Check,

$$\frac{\phi}{2} = \frac{20°40'}{2}$$

$$= 10°20'$$

Q3.) Sol:-

$\Delta AKM = 130°$

$\Delta KMC = 140°$

1st arc radius = (7952 - 300) = 7652m

2nd arc radius = (7952 - 200) = 7752m

Chainage of Intersection point = (7952 - 400) = 7552m

Tangent points = ?

Compound Curvature = ?

$\alpha = 180° - 130° = 50°$

$\beta = 180° - 140° = 40°$

$\phi = \alpha + \beta = 50° + 40° = 90°$

$I = 180 - \phi = 180° - 90° = 90°$

$KT_1 = KN = R_L \tan(\phi/2)$

$= 7652 \times \tan\left(\frac{50°}{2}\right)$

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$KT_1 = KN = 3568.1862$

$MN = MT_2 = R_s \tan\left(\frac{\beta}{2}\right)$

$= 7752 \times \tan\left(\frac{40^\circ}{2}\right)$

$= 2821.4972$

$KM = MT_2 + KT_1 = 3568.18 + 2821.49$

$KM = 6389.67$

Now,

$$\frac{BK}{MK \sin\beta} = \frac{1}{\sin I}$$

$$BK = \frac{MK \sin\beta}{\sin I} = \frac{6389.67 \times \sin 40^\circ}{\sin 90^\circ}$$

$BK = 4107.200$

$$BM = \frac{MK \sin d}{\sin I} = \frac{6389.67 \times \sin 50^\circ}{\sin 90^\circ}$$

$BM = 4894.7711$

$T_L = KT_1 + BK = 3568.1862 + 4107.200$

$T_L = 7675.3862$

$T_S = MT_2 + BM = 2821.4972 + 4894.7711$

$T_S = 7716.2683$

$L_L = \frac{\pi R_L \times \alpha}{180^\circ} = \frac{3.14 \times 7652 \times 50^\circ}{180^\circ}$

$L_L = 6674.24$

$L_S = \frac{\pi R_S \times \beta}{180^\circ} = \frac{3.14 \times 7752 \times 40^\circ}{180^\circ}$

$L_S = 5339.395$

Chainage of Intersection point

$= 7552m$

Chainage of Intersection point

$-T_L = -7675.3862$

Chainage of $T_1 = -23.38$

plus $L = +6324.26m$

$= 6300.88$

Chainage of Compound Curvature (N)

plus L_s = 5339.395

Chainage of T_2 = 11640.275 m