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MID-TERM PAPER Submission

Question 2.

* Solution:-

$R = 300m \quad \Delta = 60°$

(a) Arc definition:-

$S = 30 m,$

$$R = \frac{S}{D_a} \times \frac{180}{\pi}$$

$$:- 300 = \frac{30 \times 180}{D_a \pi} \quad \text{or} \quad D_a = 5.730.$$

(b) Chord definition:-

$$R \sin \frac{D_c}{2} = \frac{S}{2}$$

$$300 \sin \frac{D_c}{2} = \frac{30}{2}$$

$$:- D_c = 5.732.$$

(i) length of the curve:-

$$l = R\Delta \frac{\pi}{180} = 300 \times 60 \times \frac{\pi}{180}$$

$$= 314.16 m.$$

(ii) Tangent length:-

$$T = R \tan \frac{\Delta}{2} = 300 \tan \frac{60}{2}$$

$$= 173.21 m.$$

(iii) length of long chord:

$$l = 2 R \sin \frac{\Delta}{2} = 2 \times 300$$

$$\times \sin \frac{60}{2} = 300 m$$

Ans.

(iv) Mid-ordinate

$$M = R \left(1 - \cos \frac{\Delta}{2}\right) = 300$$

$$\left(1 - \cos \frac{60}{2}\right) = 40.19 m.$$

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(v) Apex distance:-

$$E = R\left(\sec\frac{\Delta}{2} - 1\right) = 300$$

$$\left(\sec\frac{60}{2} - 1\right) = 46.41\,m \text{ Ans.}$$

Question # 2.

Solution:-

$R = 200\,m \qquad \Delta = 45^\circ$

1- length of tangent

$$= 200 \tan\frac{45}{2} = 82.84\,m.$$

1- Chainage of $T_1 = 1839.2 - 82.84$

$= 1756.36\,m.$

Length of curve $= R \times 45 \times \pi/180$

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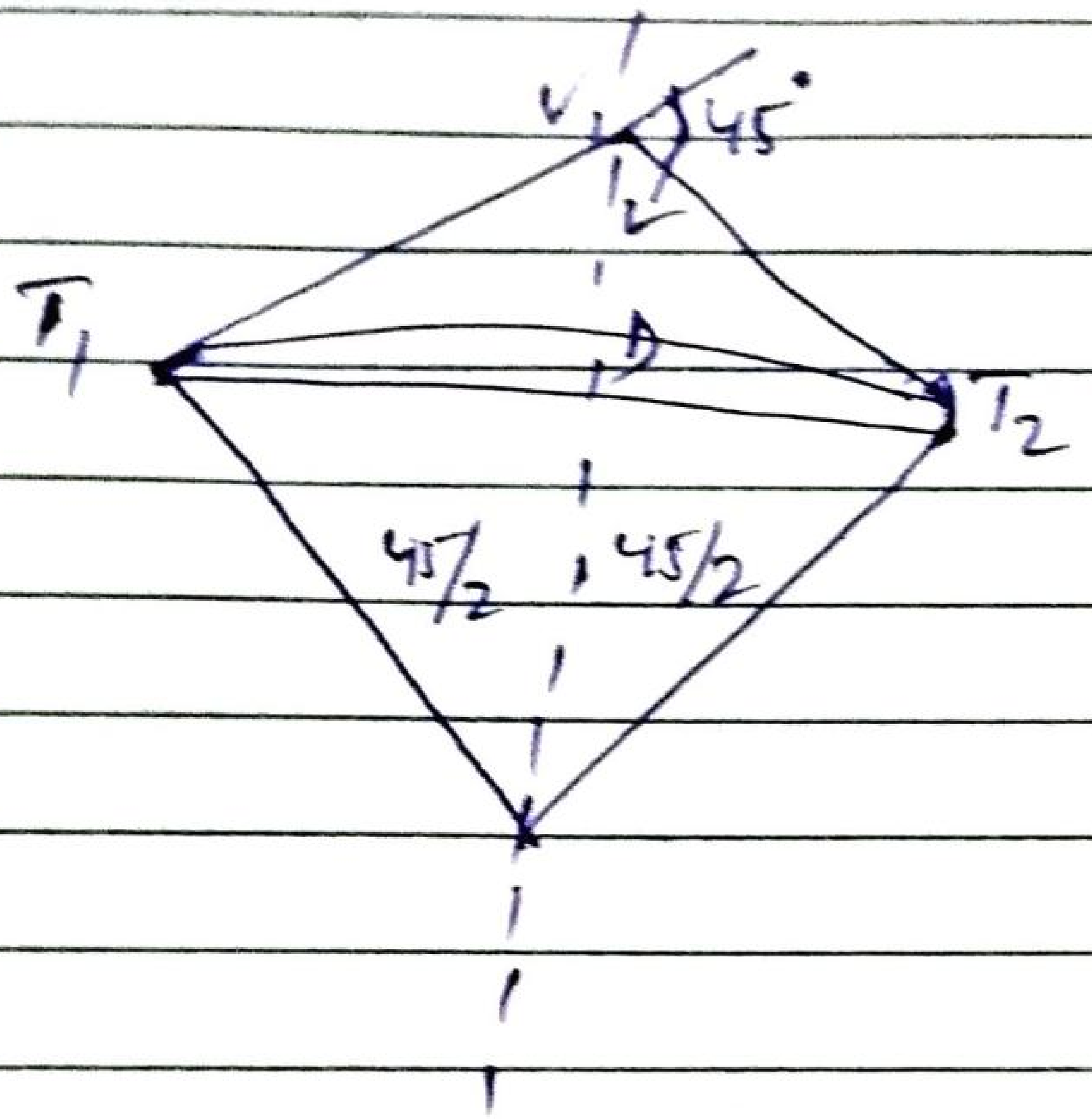
= 157.08m.

Change of forward tangent T_2

= 1756.36 + 157.08 = 1913.94m

(a) By offsets from long chord :-



Distance of DT = $L/2 = R \sin \frac{\Delta}{2}$

$= 200 \sin 45/2.$

$\boxed{= 76.54}$

Measuring "x" from D.

$y = \sqrt{R^2 - x^2} - \sqrt{R^2 - (L/2)^2}$

At $x = 0$.

$$O_0 = 200 - \sqrt{200^2 - 76.54^2}$$

$$= 200 - 184.78.$$

$$\boxed{= 15.22m}$$

$$O_1 = \sqrt{(200)^2 - (10)^2} - 184.78$$

$$= 14.97m.$$

$$O_2 = \sqrt{(200)^2 - (20)^2} - 184.78$$

$$= 14.22m.$$

$$O_3 = \sqrt{(200)^3 - (30)^2} - 184.78$$

$$= 12.96m.$$

$$O_4 = \sqrt{(200)^2 - (40)^2} - 184.78$$

$$= 11.18m.$$

$$O_5 = \sqrt{(200)^2 - (50)^2} - 184.78$$

$$= 8.87m.$$

$O_6 = \sqrt{(200)^2 - (60)^2} - 184.78$

$= 6.01 m.$

$O_7 = \sqrt{(200)^2 - (70)^2} - 184.78$

$= 2.57 m.$

At T_4 $O - 0.00$

(b) Method of bisection:-

Central ordinate at $= D - R$

$(1 - \cos \Delta/2)$

$= 200 (1 - \cos 45/2)$

$= 15.22.$

Ordinate at

$D_1 = R (1 - \cos \Delta/4) = 200$

$(1 - \cos 45/4)$

$= 3.84 m.$

ordinate at

$$D_2 = R(1-\cos \Delta/8)$$

$$= 200\,(1-\cos 45/4)$$

$$= 0.96m.$$

(c) offsets from tangents.

$$O_x = \sqrt{R^2+x^2} - R$$

Chainage of T_1 = 56.36 m.

for 30m chaining it is at

= 58 chains + 16.36 m.

$x_1 = 30 - 16.36 = 13.64.$

$x_2 = 43.64.$

$x_3 = 73.64$ m.

& last is at x tangent length = 82.94m.

$$O_1 = \sqrt{(200)^2 + (13.64)^2} - 200 = 0.46m.$$

$$O_2 = \sqrt{(200)^2 + (7364)^2} - 200 = 4.71m$$

$$O_3 = \sqrt{(200)^2 + (7364)^2} - 200 = 13.13m$$

$O_4 = \sqrt{(200)^2 + (82.84)^2} - 200$

$= 16.48m.$

(ii) offsets from chord produced

length of first sub chord

$= 13.64 = C_1$

length of normal chord $= 30 = C_2$

Since length chain is 157.08m

$C_3 = C_4 = C_5 = 30$

Chainage of forward tangent

$= 1913.44m.$

$= 63$ chains $+ 23.44.$

$$O_1 = \frac{C_1^2}{2R} = \frac{13.64^2}{2 \times 200} = 0.47$$

$$O_2 = \frac{C_2(C_1 + C_2)}{2R} = \frac{30(30 + 13.64)}{2 \times 200}$$

$= 3.27.$

$$O_4 = \frac{C_n(C_{n-1} + C_n)}{2R} = \frac{23.44(23.44 \times 30)}{2 \times 200}$$

$$= 3.13m.$$

Question #3
Solution:-

$R = 17.5 \times 20 = 350m.$

$\Delta = 32°40' = 32.667°$

$\frac{\Delta}{2} = 16°20'.$

Tangent length $T = R \tan \Delta/2$

$= 350 \times \tan 16°20' = 102.57m$

length of curve $l = \frac{\pi R \Delta}{180}$

$= \frac{\pi \times 250 \times 32.667}{180}$

$= 199.55m$

Chainage of T_1 = chainage of P.I − T

$= (51 + 9.35) - 102.57$

$= (51 \times 20 + 9.35) - 102.57$

$= 926.78m = 46 + 6.78.$

Chainage of T_2 = Chainage of T_1 + l

$= 926.78 + 199.55 = 1126.33\,m$

$= 56 + 6.33$.

length of first sub chord

$C_f = (46+20) - (46+6.78) = 13.22\,m$.

$C_I = (56+6.33) - (56+0) = 6.33$.

$N = 56 - 47 = 9$.

$n = 9+2 = 11$.

Coordinates T_1 & T_2.

Bearing of $IT_1 = \alpha = 180^\circ +$ bearing of $T_1 L$

$= 180^\circ + 78^\circ 36' 30''$

$= 258^\circ 36' 30''$

Bearing of $IT_2 = \beta =$ Bearing of $IT_1 - \phi$

$= (180^\circ - \Delta)$

$= 258^\circ 36' 30'' - (180^\circ - 32^\circ 40')$

$= 111^\circ 16' 30''$.

Coordinates of T_1

Easting of $T_1 = E_4 =$ Easting of $1 + T \sin \alpha$

$= 1058.55 + 102.57 \times \sin 258^\circ 36' 30''$

$= E\ 958.00m$.

$= 1045.04 + 102.57 \times \cos 258^\circ 36' 30''$

$= E = 1154.13m$.

Northing $T_2 = N_4 = 1045.04 + 102.57 \times \cos 111^\circ 16' 30''$

$= N = 1007.812m$

Tangential angles

$\delta = 1718.9 \frac{C}{R}$ minutes

$\delta_1 = 1718.9 \frac{13.22}{350} = 64.925'$

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δ_2 to δ_{10} $= 1718.9 \dfrac{20}{350} = 98.223'$

$\delta_{11} = 1718.9 \dfrac{6.33}{350} = 31.088'$.

Deflection Angles.

$\Delta_1 = \delta_1 = 64.925' = 1°04'55''$

$\Delta_2 = \Delta_1 + \delta_2 = 64.925' + 98.223'$

$= 163.148' = 2°43'09''$

CURVE RANGING :-

$\Delta_3 = \Delta_2 + \delta_3 = 163.148' + 98.223'$

$= 261.371' = 4°21'22''$

$\Delta_4 = \Delta_3 + \delta_4 = 261.371 + 98.223'$

$= 359.594' = 5°59'36''$

$\Delta_5 = \Delta_4 + \delta_5 = 359.594' + 98.223'$

$= 457.817' = 7°37'39''$

$\Delta_6 = \Delta_5 + \delta_6 = 457.817' + 98.223'$

$= \cancel{457}\ 556.040 = 9°16'02''$

$\Delta_{11} = \Delta_{10} + \delta_{11} = 948.932'$

$+ 31.088' = 980.020'$

$= 16°20'00''$.

Chenk $\Delta_{11} = \frac{\Delta}{2} = 16°20'$ (okay)