Day: M T W T F S

Date: __/__/__

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Section No B

paper Advanced Engineering Survey 2

Date 24/08/2020.

University Iqra National University Peshawar.

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Q No (02) :-

Given Data.

$R = 300\ m$

Sol. $\Delta = 60°$.

Solution: (a) Arc Definition.

$S = 30m$.

We know that.

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

$$\Rightarrow 300 = \frac{30 \times 180}{Da\,\pi}$$

$$Da = \frac{30 \times 180}{300 \times \pi}$$

$$Da = 5.730\ ms$$

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(b) (chord Definition.

We know that.

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

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

$D_c = 5.732.$ Ans:

(i) length of the curve.

We know that

$I = \frac{RA\pi}{180}$

$= \frac{300 \times 60 \times \pi}{180} = 314.16\,m$

$I = 314.16m$

(ii) Tangent length.

We know that

$T = R \tan \frac{A}{2}$

$= 300 \tan \frac{60}{2} = 173.21m$

$T = 173.21m$

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(iii) length of long chord.

We know that.

$$L = 2R \sin \frac{\Delta}{2}$$

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

$$L = 300\,m$$

(iv) Mid - ordinate.

We know that

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

$$= 300\left(1 - \cos \frac{60}{2}\right) = 40.19\,m$$

$$M = 40.19\,m$$

(v) Apex distance.

We know that.

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

$$= 300\left(\sec \frac{60}{2} - 1\right)$$

$$E = 46.41\,m$$

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Q No (02)

Solution:

$R = 200m$

$\Delta = 45^\circ$

length of tangent

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

Chainage of $T_1 = 1839.2 - 82.84$

$= 1756.36m$

length of curve =

$= R \times 45 \times \frac{\pi}{180}$

$= 157.08m$

Chainage of forward tangent T_2

$= 1756.36 + 157.08$

$= 1913.44m$

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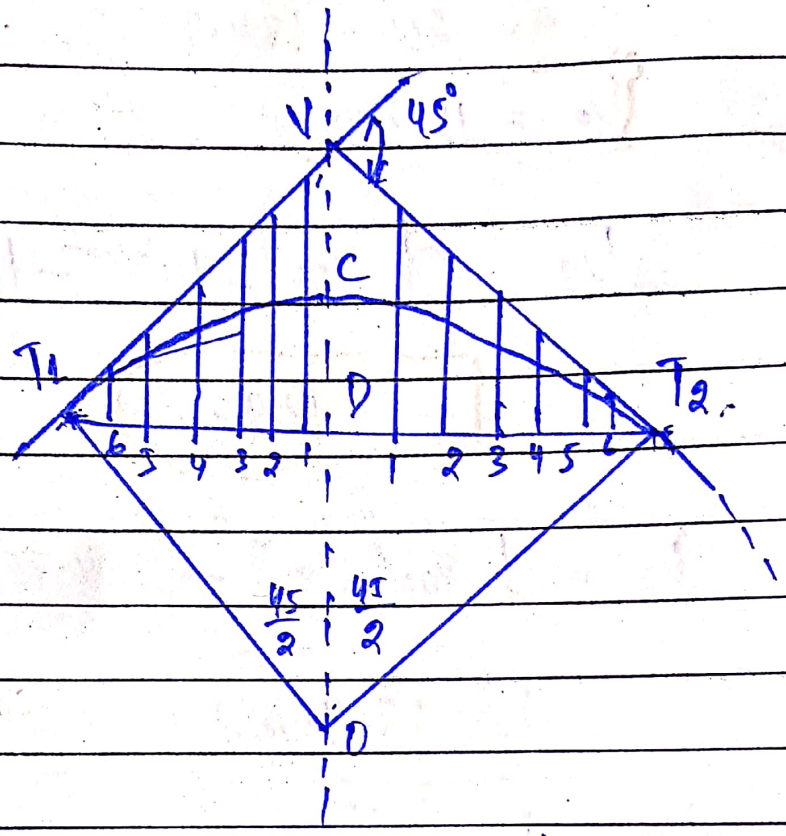
(a) By offsets From long Chord.



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

$= 200 \sin \frac{45}{2}$

$= 76.54.$

Measuring 'x' From D,

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

At $x = 0$

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$$D_0 = 200 - \sqrt{200^2 - 76.54^2}$$

$$= 200 - 184.78$$

$$D_0 = 15.22\text{m}.$$

$$D_1 = \sqrt{200^2 - 10^2} - 184.78$$

$$= 14.97\text{m}$$

$$D_3 = \sqrt{200^2 - 30^2} - 184.78$$

$$= 12.96\text{m}$$

$$D_4 = \sqrt{200^2 - 40} - 184.78.$$

$$= 11.18\text{m}$$

$$D_5 = \sqrt{200^2 - 50^2} - 184.78 = 8.87\text{m}$$

$$= 8.87\text{m}$$

$$D_6 = \sqrt{200^2 - 60^2} - 184.78$$

$$= 6.01\text{m}$$

$$D_7 = \sqrt{200^2 - 70^2} - 184.28$$

$$= 2.57\text{m}$$

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At T_2, $O = 0.00$

(b) Method of bisection.

Central ordinate at

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

$$= 200\left(1 - \cos\frac{45}{2}\right)$$

$$D = 15.22$$

Ordinate At D_1.

$$D_1 = R\left(1 - \cos\frac{\Delta}{2}\right)$$

$$= 200\left(1 - \cos\frac{45}{4}\right)$$

$$D_1 = 3.84m$$

Ordinate At D_2

$$D_2 = R\left(1 - \cos\frac{D}{8}\right)$$

$$= 200\left(1 - \cos\frac{45}{8}\right)$$

$$D_2 = 0.96m$$

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(c) OFFsets From Tangents.

Radial OFFsets

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

Chainage of T_2 = 1756.36m

For 30m chain, it is at.

= 58 Chains + 16.36m

$$X_1 = 30 - 16.36 = 13.64$$

$$X_2 = 43.64m$$

$$X_3 = 73.64m.$$

and the last is at

X_4 = tangent length = 82.84m.

$$O_2 = \sqrt{200^2 + 13.64^2} - 200$$

$$O_2 = 0.46m$$

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$O_2 = \sqrt{200^2 + 43.64^2} - 200$

$O_2 = 4.71\,m$

$O_3 = \sqrt{200^2 + 73.64^2} - 200$

$O_3 = 13.13\,m$

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

$O_4 = 16.48\,m$

(d) OFFsets From chord produced

length of First sub-chord
$= 13.64\,m = C_1$

length of normal Chord
$= 30\,m = C_2$

Since length of
Chain is 157.08m,
$C_3 = C_4 = C_5 = 30m$

Chainage of forward tangent

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$= 1913.44m$

$= 63 \text{ chains} + 23.44m$

∴ length of last chord $= 23.44m = C_n = C_6$

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

$$O_1 = 0.47m$$

$$O_2 = \frac{C_2(C_2 + C_2)}{2R}$$

$$= \frac{30(30 + 13.64)}{2 \times 200} = 3.27m$$

$$O_3 = \frac{C_2^2}{R} = \frac{30^2}{2 \times 200}$$

$$= 4.5m = O_4 = O_5$$

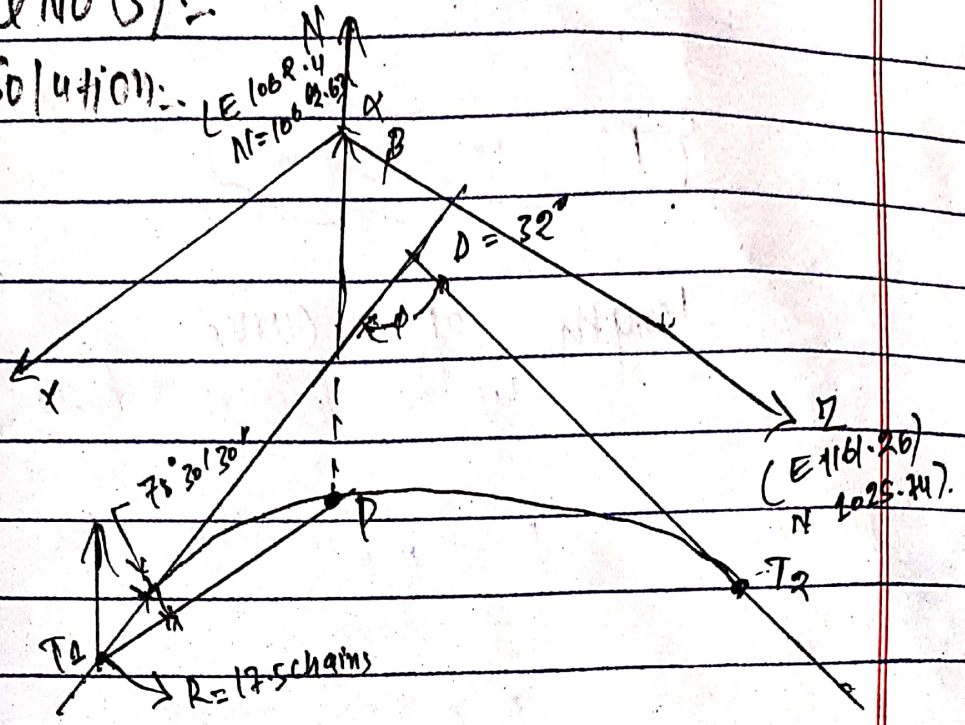
$$O_6 = \frac{C_n(C_{n-2} + C_n)}{2R}$$

$$= \frac{23.44(23.44 + 30)}{2 \times 200}$$

$$O_6 = 3.13m$$

Q NO (3):-

Solution:-



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

$R = 350\ m.$

$\Delta = 32°40' = 32.667°.$

$\Delta = 32.667°.$

$\frac{\Delta}{2} = 16°20'$

Tangent length

$T = R \tan \frac{\Delta}{2}$.

$= 350 \times \tan 16°20'$

$T = 102.57\ m$

length of curve

$$I = \frac{\pi R \Delta}{180}$$

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

$I = 199.55\ m$

Chainage of T_1.

Chainage of T_1 = Chainage of P.I − T

$= (51 + 9.35) - 102.57.$

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

$= 926.78\ m = 46 + 6.78.$

Chainage of T_2

Chainage of T_2 = Chainage of $T_1 + I$

$= 926.78 + 199.55 = 1126.33m.$

$= 56 + 6.33.$

Length of first sub-chord,

$C_f = (46+20) - (46+6.78)$

$= 13.22m.$

Length of last sub-card.

$C_L = (56+6.33) - (56+0)$

$= 6.33m$

Number of normal chords.

$N = 56 - 47 = 9.$

$N = 9$

Total Number of chords.

$n = 9 + 2 = 11.$

$n = 11.$

Coordinates of T_1 and T_2.

Bearing of IT_1

$IT_1 = \alpha = 180° + \text{bearing of } T_2L$

$= 180° + 78°36'30''$

$= 258°36'30''$

Bearing of IT_2

$IT_2 = \beta = \text{Bearing of } IT_1 - \phi$

$= \text{Bearing of } IT_1 - (180° - \Delta)$

$= 258°36'30'' - (180° - 32°40')$

$= 111°16'30''$

Coordinates of T_1.

Easting of $T_1 = ET_1 = \text{Easting of } I + T\sin\alpha$

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

$= E\ 958.00m.$

Northing of T_2

$T_2 = NT_2 =$ Northing of $I + T\cos\alpha$

$= 1045.04 + 102.57 \times \sin 111°16'30''$

$= N\ 1024.78m.$

Coordinates of T2.

Easting of $T_2 = ET_2 =$ Easting of $I + T\sin\beta$

$= 1058.55 + 102.57 \times \sin 111°16'30''$

$= E\ 1154.13m$

Northing of T_2.

$T_2 = NT_2 =$ Northing of $I + T\cos\beta$

$= 1045.04 + 102.57 \times \cos 111°16'30''$

$= N\ 1007.812m$

Tangential angles.

We know that.

$$\delta = 1718.9 \frac{c}{R} \text{ minutes}$$

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

$$\delta_1 = 64.925'$$

$$\delta_2 \text{ to } \delta_{10} = 1718.9 \frac{20}{350}$$

$$= 98.223'$$

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

$$\delta_{11} = 31.088'$$

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.

$\Delta_3 = \Delta_2 + \delta_3 =$

$= 163.148' + 98.223' = 261.371'$

$= 4°21'22''$

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

$= 359.594'$

$= 5°59'36''$

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

$= 457.817' =$

$= 7°37'39''$

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

$= 556.040'.$

$= 9°16'02''$

$\Delta_7 = \Delta_6 + \delta_7 = 556.040' + 98223'$

$= 654.263'$

$= 10°54'16''$

$\Delta_8 = \Delta_7 + \delta_8 = 654.263 + 98223'$

$= 752.486'$

$= 12°32'29''$

$\Delta_9 = \Delta_8 + \delta_9 = 752.486' + 98223'$

$= 850.709'$

$= 14°10'43''$

$\Delta_{10} = \Delta_9 + \delta_{10} = 850.709' + 98223'$

$= 948.932'$

$= 15°48'56''$

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

$= 948.932' + 31.088'$

$= 980.020' = 16°20'00''$

Check

$\Delta_{11} = \frac{\Delta}{2} = 16°20'$