MID TERM EXAM

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DEPARTMENT : BE(Civil)

SECTION : "B"

SUBJECT : ADVANCE ENGINEERING SURVEY II

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QUESTION No. 1(A)

GIVEN DATA:

Degree of Curve = 5°

Deflection Angle, $\Theta = 14° 13' 23''$

Chainage Intersection = 7954 ft (JD)

REQUIRED DATA:

(i) Chainge at the beginning and end of Curve.

(ii) Length of long cord

(iii) Mid ordinate and External distance.

SOLUTION:

$$\text{Radius} = \frac{5729.28}{D}$$

$$\Rightarrow R = \frac{5729.28}{5°}$$

$$\Rightarrow \boxed{R = 1145.85 \text{ ft.}}$$

(i) LENGTH OF LONG CORD:

$$\text{Length of long cord} = 2R \sin \Theta/2$$

$$\Rightarrow L = 2(1145.85) \sin\left(\frac{14°13'23''}{2}\right)$$

$\Rightarrow L = 2291.7 \ \& in (7°6'41.5")$

$\Rightarrow \boxed{L = 283.7150 \text{ ft}}$

(ii) MID ORDINATE:

$$\text{Mid ordinate} = R(1 - \cos\Theta/2)$$

$$\Rightarrow \text{Mid ordinate} = 1145.85 \left(1 - \cos \frac{14°13'25"}{2}\right)$$

$$\Rightarrow \text{Mid ordinate} = 1145.85 (1 - \cos 7°6'41.5")$$

$$\Rightarrow \text{Mid ordinate} = 1145.85 (1 - 0.9923)$$

$$\Rightarrow \text{Mid ordinate} = 1145.85 (7.7 \times 10^{-3})$$

$$\Rightarrow \boxed{\text{Mid ordinate} = 8.823 \text{ ft}}$$

iii) EXTERNAL DISTANCE:

$$\text{External Distance} = R\left(\frac{1}{\cos\Theta/2} - 1\right)$$

$$\Rightarrow \text{External Distance} = 1145.85 \left(\frac{1}{\cos\left(\frac{14°13'25"}{2}\right)} - 1\right)$$

$$\Rightarrow \text{External Distance} = 1145.85 \left(\frac{1}{\cos 7°6'41.5"} - 1\right)$$

$$\Rightarrow \text{External Distance} = 1145.85 \left(\frac{1}{0.9923} - 1\right)$$

$\Rightarrow$ External Distance $= 1145.85\,(7.759 \times 10^{-3})$

$\Rightarrow$ **External Distance = 8.891 ft**

iv) TANGENT LENGTH:

$$\text{Tangent Length} = R \tan \frac{\Theta}{2}$$

$$\Rightarrow \text{Tangent length} = 1145.85 \tan\left(\frac{14°13'25''}{2}\right)$$

$$\Rightarrow \text{Tangent Length} = 1145.85 \tan(7°6'41.5'')$$

$$\Rightarrow \text{Tangent length} = 1145.85\,(0.124)$$

$\Rightarrow$ **Tangent length = 142.08 ft.**

Now $$\text{length of curve} = \frac{\pi R \Theta}{180°}$$

$$\Rightarrow \text{length of curve} = \frac{3.14 \times 1145.85 \times 14°13'23''}{180°}$$

$\Rightarrow$ **length of curve = 284.30 ft.**

At last

Intersection chainage	=	7954 ft
Minus Tangent length	=	− 142.08 ft
T_1	=	7811.92 ft
Add Curve length	=	+ 284.30 ft
T_2	=	8096.22 ft.

QUESTION No. 1(b)

GIVEN DATA:

Chainage (m)	0	30	60	90	120	150
offset (m)	7.954	10.954	11.954	5.954	3.954	4.954

offset = 6

Intercept = 5

Interval = 30

REQUIRED DATA:

Find the Area of this chain Survey.

SOLUTION:

As Intercept is even number, so we will Calcuta area from 1st to 5th and the area b/w 5th and 6th is calculated separately.

Offset No.	Offset	Simpson's Multipler	Product.
1(E)	7.954	1	7.954
2(O)	10.954	4	43.816
3(E)	11.954	2	23.908
4(O)	5.954	4	23.816
5(E)	3.954	1	3.954
			$\Sigma = 103.448$

$$\text{Area } (h_1 - h_5) = \frac{30}{3}(103.448) = 1034.48\ m^2$$

$$\text{Area } (h_5 - h_6) = \frac{30}{2}(3.954 + 4.954) = 133.62\ m^2$$

Total Area = 1034.48 + 133.62

$\Rightarrow$ **Total Area = 1168.1 m^2.**

QUESTION NO. 02

GIVEN DATA:

$\theta = 20^\circ 40'$

Radius = 7954 ÷ ~~12~~ (Assume)

= 662.83 m

Intersection Chainage = ID - 400

= 7954 - 400

= 7554

Pig Interval = 20 m

REQUIRED DATA:

Calculate all the data by deflection Angle method.

SOLUTION:

$$\text{Tangent length} = R \tan \frac{\Theta}{2}$$

$$= 662.83 \tan \frac{20°40'}{2}$$

$$= 120.85\text{m}$$

$$\text{Length of Curve} = \frac{R \times \Theta}{180}$$

$$= \frac{662.83 \times 3.14 \times 20°40'}{180°}$$

$$= 238.96\text{m}$$

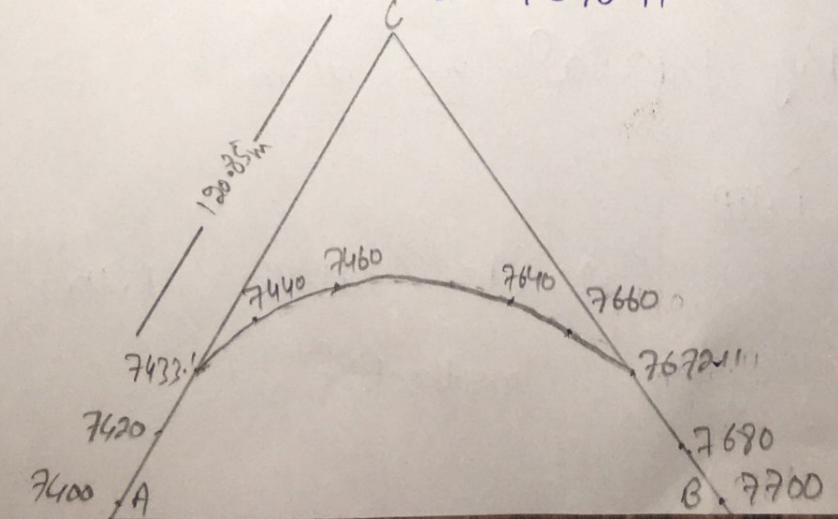
Intersection Chainage = +7554

Minus Tangent length = − 120.85

(T_1) = 7433.15

Add Curve length = + 238.96

(T_2) = 7672.11



FOR INITIAL CORD:

7400 7420 7433.1 7440 7460

Initial Cord = 7440 − 7433.1

⇒ Initial Cord = 6.9m (C_1)

FOR FINAL CORD:

7640 7660 7672.11 7680 7700

Final Cord = 7672.11 − 7660

⇒ Final Cord = 12.11 m (C_{12})

For No. of Cords:

= 7660 − 7440

= 220

Pig Internal = 20

So divide by 20, we get.

$= \frac{220}{20}$

⇒ No. of Cord = 11

And $C_2 = C_3 = C_4 = C_5 = C_6 = C_7 = C_8 = C_9 = C_{10} = C_{11} = C_{12}$

BY DEFLECTION ANGLE:

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

$$\Rightarrow \delta_1 = \frac{1718.9 \times 6.9}{60 \times (662.83)}$$

$$\Rightarrow \boxed{\delta_1 = 0^\circ 17' 53.62''}$$

$$\delta_{13} = \frac{1718.9 \times C_{12}}{60R}$$

$$\Rightarrow \delta_{13} = \frac{1718.9 \times 12.11}{60 \times 662.83}$$

$$\Rightarrow \boxed{\delta_{13} = 0^\circ 31' 24.27''}$$

Now $\delta_2 = \frac{1718.9 \times C_2}{60R}$

$$\Rightarrow \delta_2 = \frac{1718.9 \times 20}{60 \times 662.83}$$

$$\Rightarrow \boxed{\delta_2 = 0^\circ 51' 51.93''}$$

So $\delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = \delta_8 = \delta_9 = \delta_{10} = \delta_{11} = \delta_{12}$

TOTAL DEFLECTIONS FOR CORD:

$\Delta_1 = \delta_1 = 0^\circ 17' 53.62''$

$\Delta_2 = \delta_1 + \delta_2 = \Delta_1 + \delta_2 = 1^\circ 9' 45.55''$

$\Delta_3 = \Delta_2 + \delta_3 = 1^\circ 9' 45.55'' + 0^\circ 51' 51.93'' = 2^\circ 1' 37.48''$

$\Delta_4 = 2^\circ 58' 29.41''$

$\Delta_5 = 3^\circ 45' 21.34''$

$\Delta_6 = 4^\circ 37' 13.27''$

$\Delta_7 = 5^\circ 29' 5.2''$

$\Delta_8 = 6^\circ 20' 57.13''$

$\Delta_9 = 7^\circ 12' 49.06''$

$\Delta_{10} = 8' 4' 40.99''$

$\Delta_{11} = 8^\circ 56' 32.92''$

$\Delta_{12} = 9^\circ 48' 24.85''$

$\Delta_{13} = \Delta_{12} + \delta_{13} = 9^\circ 48' 24.85' + 0^\circ 31' 24.27'' = 10^\circ 19' 49.12''$

Check $= \Delta_{13} = \frac{\theta}{2} = \frac{20^\circ 40'}{2} = 10^\circ 20'$

QUESTION NO. 03

GIVEN DATA:

$$\angle AKM = \alpha = -130^\circ + 180^\circ = 50^\circ$$

$$\angle KMC = \beta = -140^\circ + 180^\circ = 40^\circ$$

$$R_1 = \text{Radius} = ID - 300$$
$$= 7954 - 300$$
$$= 7654\,m$$

$$R_2 = \text{Radius} = ID - 400$$
$$= 7954 - 400$$
$$= 7554\,m$$

Chainage of Intersection Point = ID - 400

$$= 7954 - 400$$
$$= 7554\,m$$

REQUIRED DATA:

Tangent points = ?

Compound curvature = ?

SOLUTION:

$$\Delta = \alpha + \beta = 40^\circ + 50^\circ = 90^\circ$$

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

Now $KT_1 = KN = R_1 \tan(\Delta/2)$

$= 7654 \tan(50°/2)$

$= 3569.11m$

Now $MN = MT_2 = R_2 \tan(\beta/2)$

$= 7754 \tan(40°/2)$

$= 2822.22m$

So $MN = MT_2 = 2822.22m$

$KM = MT_2 + KT_1 = 3569.11 + 2822.22$

$= 6391.335m$

Now Find $\angle BKM$ by Sine Rule.

$$BK = \frac{MK \sin B}{\sin I}$$

$$= \frac{6391.33 \sin(40)}{\sin 90°}$$

$$\Rightarrow \boxed{BK = 4108.26\ m}$$

$$BM = \frac{MK \cdot \sin\alpha}{\sin I}$$

$$\Rightarrow BM = \frac{6391.33 \sin 50°}{\sin 90°}$$

$\Rightarrow \boxed{BM = 4896.04m}$

$T_1 = KT_1 + B\alpha$

$= 3569.11 + 4808.26$

$= 7677.37m$

$T_8 = MT_2 + BM$

$= 2822.22 + 4896.04$

$= 7718.26$

$L_1 = \frac{\pi R_1 \alpha}{180^\circ}$

$\Rightarrow L_1 = \frac{3.14 \times 7654 \times 50^\circ}{180^\circ}$

$\Rightarrow \boxed{L_1 = 6675.98m}$

$L_S = \frac{\pi R_2 B}{180^\circ}$

$\Rightarrow L_S = \frac{3.14 \times 7754 \times 40^\circ}{180^\circ}$

$\Rightarrow \boxed{L_S = 5410.56m}$

Chainage of Intersection Point,

$= 7554m$

Chainage of T_1 = Chainage of intersection $- T_L$

$= 7554 - 7677.37$

$= -123.37m$

Plus L_L $= -123.37 + 6675.98$

$= 6552.61m$

Chainage of Compound Curvature.

Plus L_S $= 5410.56 + 6552.61$

(T_2) $= 11963.17m$