BE(C) 4th Semester mid-exam

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Section:- 'A'

Subject:- Advance Engineering Surveying

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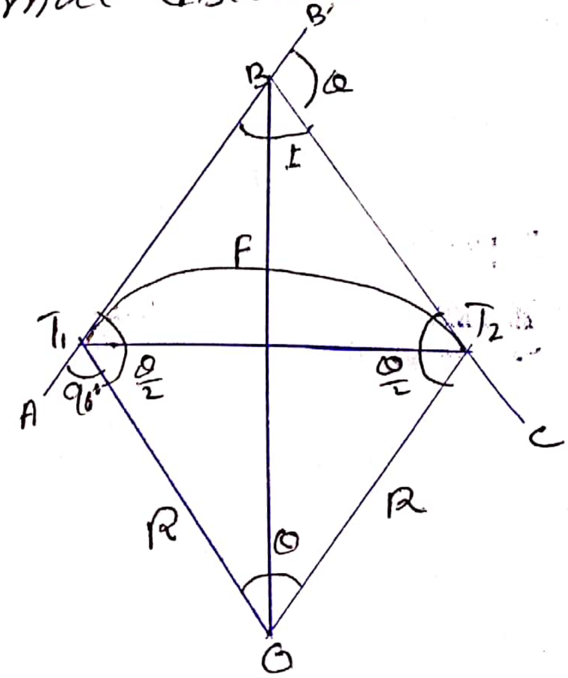
Question No. 01 (a)

Two tangents meet at a chainage of (ID)ft with the deflection angle of 14°13'25".

Degree of Curve is 5°. Calculate
(i) chainage at begining and end of curve.
(ii) Length of long chord.
(iii) mid ordinate and external distance.



Solution

my ID is 7914

ID = 7914

Degree of Curve = 5°

$$R = \frac{5729.58}{5} = 1145.916\ ft$$

So,

- Tangent length:

$$BT_1 = BT_2 = R\tan\left(\frac{\theta}{2}\right) = 1145.916 \times \tan\left(\frac{14°13'25''}{2}\right)$$

$$\Rightarrow BT_1 = BT_2 = 142.9655\ ft$$

- length of Curve, L

$$\Rightarrow L = \left(\frac{\pi R \theta}{180°}\right)$$

$$\Rightarrow L = \frac{\pi \times 1145.916 \times 14°13'25''}{180°}$$

$$\boxed{L = 233.46\ ft.}$$

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Now, to find chainage;

chainage of intersection point = B = ~~7914ft~~ 7914ft

$\Rightarrow T_1 = 7914 - 142.9655 = 7771.03ft$

$\Rightarrow \boxed{T_1 = 7771.03ft}$

$T_2 = 7771.03 + 284.46$ (curve length)

$\Rightarrow \boxed{T_2 = 7486.588}$

length of chord;

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

$= 2 \times 1145.916 \times \sin\left(\frac{14°3'25''}{2}\right)$

$l = 283.731ft$

mid ordinates;

$EF = R\left(1 - \cos\frac{\theta}{2}\right)$

$= 1145.916\left(1 - \cos\left(\frac{14°3'25''}{2}\right)\right)$

$\Rightarrow \boxed{EF = 8.8154ft}$

External distance;

$BF = R\left(\frac{1}{\cos\left(\frac{\theta}{2}\right)} - 1\right)$

$BF = 1145.916\left(\frac{1}{\cos\left(\frac{14°3'25''}{2}\right)} - 1\right)$

$\boxed{BF = 8.8838ft}$

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Q No. (01) (b)

Ans:-

chainage(m)	0	30	60	90	120	150
offset(m)	7.914	7.914+3 = 10.914	7.914+4 = 11.906	7.914−2 = 5.914	7.914−4 3.914	7.914−3 = 4.914

from question; $b = 30\,m$

So, using Simpson Rule.

$$Area = \frac{b}{3}\Big(7.914 + 3.914 + 2(11.914) + 4(10.914) + 4(5.904)\Big) + \left(\frac{3.914 + 4.904}{2}\right) \times b\Big)$$

$b = 30$

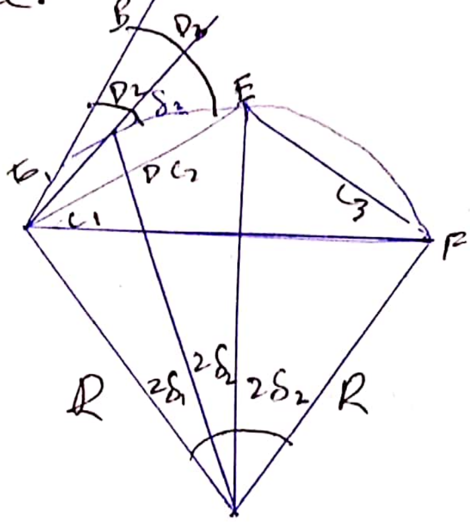
$\Rightarrow Area = 1244.52 + 132.42$

$\Rightarrow \boxed{Area = 1376.94\,m^2}$

Q No. 02 (a) (5)

A Circular curve of Radius (ID-200m), deflection angle 20°40' is to be set out between the two Straights having chainage of the point of intersection as (ID-4600)m.

Calculate all the data necessory for setting out curve using deflection angle.



We assume the radius as

ID − ~~70500~~ 7500

= 7914 − 7500 = 414m

$\Rightarrow \boxed{R = 414m}$

deflection angle = 20°40'

Chainage at point of intersection which also assume as ID−3600 = 7914−3600

$\Rightarrow \boxed{\text{chainage} = 4314m}$

peg interval = 20m

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So: We can find tangent length

$BT_1 = BT_2 = R\tan(\frac{\theta}{2})$

$= 414 \times \tan(\frac{20°40'}{2})$

$\boxed{BT_1 = T_2B. \quad = 530.97\,m}$

Length of Curve:

$L = \frac{\pi R \theta}{180°}$

$L = \frac{\pi \times 414 \times 20°40'}{180°}$

$\boxed{L = 149.249\,m}$

chainage at T_1:

$T_1 = 4314 - 530.97$ (tangent length)

$\boxed{T_1 = 3783.03}$

and $T_2 = 3783.03 + 149.249$ (length of curve)

$\boxed{T_2 = 3932.28}$

Length of Chords:

1st chord: $C_1 = 3810 - T_1 = \underset{\text{assume}}{3810} - 3783.03$

$\Rightarrow \boxed{C_1 = 26.97\,m}$

2nd chord; $C_2 = 3932.28 - \underset{\text{(assume)}}{3900}$

$\boxed{C_{20} = 32.28\,m}$

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No. of chords;

$$\text{No. of Chords} = \frac{\text{length of Curve} - C_1}{\text{interval}}$$

$$= \frac{149.249 - 26.97}{20}$$

$$\boxed{= 10 \text{ chords.}}$$

as we know

$$C_2 = C_3 = C_4 = C_5 = C_6 = C_7 = C_8 = C_9$$

$$= 20m$$

deflection angle;

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

$$= \frac{1718.9 \times 26.97}{60 \times 414}$$

$$\boxed{\delta_1 = 1^\circ 51' 66''}$$

$$\delta_2 = \frac{1718.9 \times 20}{60 \times 414}$$

$$\Rightarrow \boxed{\delta_2 = 1^\circ 23' 2''}$$

as;

$$\delta_2 = \delta_3 = \cdots\cdots = \delta_9 = 1^\circ 23' 2''$$

$\longrightarrow$

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$$\Rightarrow \delta_{10} = \frac{1718.9 \times C_{10}}{60 \times R} = \frac{1718.9 \times 32.28}{60 \times 414}$$

$$\Rightarrow \boxed{\delta_{10} = 2^\circ 14' 1''}$$

Total deflection angle for chords are;

$$D_1 = \delta_1 = 1^\circ 51' 66''$$

$$D_2 = D_1 + \delta_2 = 1^\circ 51' 66'' + 1^\circ 23' 2''$$

$$\Rightarrow D_2 = 3^\circ 15' 88''$$

$$D_3 = D_2 + \delta_3 = 3^\circ 15' 88'' + 1^\circ 23' 2'' \qquad (\because \delta_2 = \delta_3)$$

$$\Rightarrow D_3 = 4^\circ 38' 10''$$

$$D_4 = D_3 + \delta_4 = 4^\circ 38' 10'' + 1^\circ 23' 2''$$

$$\Rightarrow D_4 = 6^\circ 1' 12''$$

$$D_5 = D_4 + \delta_5 = 6^\circ 1' 12'' + 1^\circ 23' 2''$$

$$\Rightarrow D_5 = 7^\circ 24' 14''$$

$$D_6 = D_5 + \delta_6 = 7^\circ 24' 14'' + 1^\circ 23' 2''$$

$$\Rightarrow D_6 = 8^\circ 47' 16''$$

$$D_7 = D_6 + \delta_5 = 8^\circ 47' 16'' + 1^\circ 23' 2''$$

$$\Rightarrow D_7 = 10^\circ 10' 18'' \longrightarrow$$

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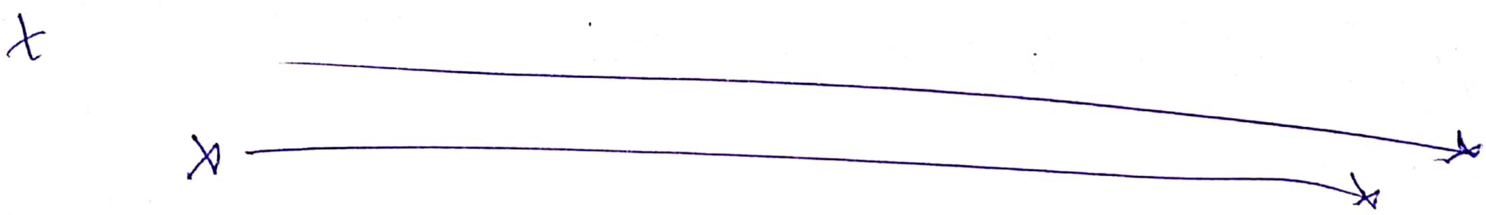
$D_8 = D_7 + \delta_6 = 10^\circ 10' 18'' + 1^\circ 23' 2''$

$\Rightarrow D_8 = 11^\circ 33' 20''$

$D_9 = D_8 + \delta_7 = 12^\circ 56' 22''$

$D_{10} = D_9 + \delta_8 = 14^\circ 19' 24''$

check $= \frac{\Delta}{2} = \frac{20^\circ 40'}{2} = 10^\circ 20'$ corrected.



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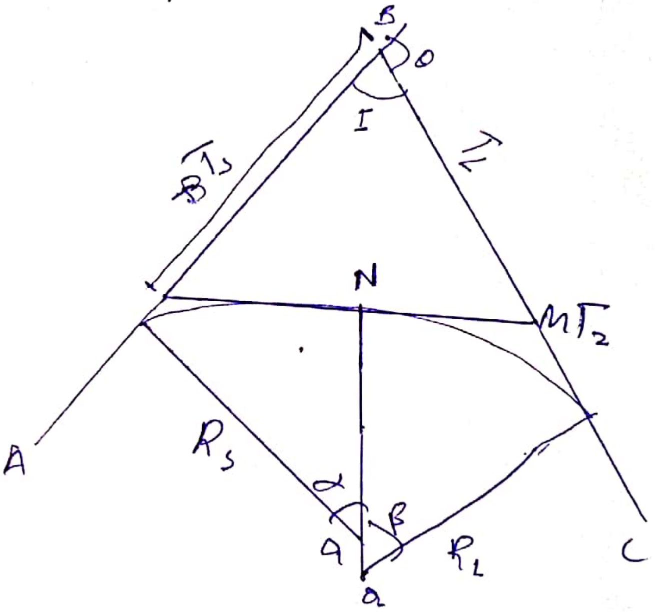
Question No.03

Two tangents AB and BC are intersected by a line KM. The angles ~~AKM~~ AKM and KMC are $130°$ and $140°$. Radius of 1st arc is (ID − 300) m and of 2nd ~~arct~~ arc is (ID − 200) m

find the chainage of tangent points and the point of compound curve given that the chainage of intersection point is (ID − 400) m.



Sol:- Given that;

$ID = 7914$ $\quad \alpha = 130°$

$\beta = 140°$

Radius of 1st arc $= 7914 - 300 = 7614\,m$

Radius of 2nd Arc $= 7914 - 200 = 7714\,m$

Chainage at intersection point

$= 7914 - 400 = 7514\,m$

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Now $\alpha = 180° - 130° = \cancel{40°}\ 50°$

$\beta = 180° - 140° = 40°$

$\Rightarrow \phi = \alpha + \beta = 90°$

and $I = 180° - \phi = 180 - 90°$

$\Rightarrow I = 90°$

$\Rightarrow KT_1 = KN = R_{small} \tan(\frac{\alpha}{2}) = 7614 \tan(\frac{50}{2})$

$\Rightarrow KT_1 = KN = 3550.4\ m$

Simillarly;

$MN = MT_2 = R_{Large} \tan(\beta/2) = \cancel{76}\,17714 \tan(\frac{40}{2})$

$\Rightarrow MN = MT_2 = 2807.66\ m$

Now;

$KM = MT_2 + KN = 2807.66 + 3550.4$

$\Rightarrow KM = 6358.06\ m$

furthermore, $\triangle BKM$ is given by Sine rule

$\rightarrow$

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

$$\Rightarrow BK = \frac{MK \cdot \sin\beta}{\sin(I)} = \frac{6358.06 \cdot \sin(40)}{\sin(90°)}$$

$$\Rightarrow \boxed{BK = 4086.8m}$$

$$BM = \frac{MK\ \sin(\alpha)}{\sin(I)} = \frac{6358.06\ \sin(50)}{\sin(90)}$$

$$\Rightarrow \boxed{BM = 4870m}$$

Now,

$$T_s = KT_1 + BK = 3550.04 + 4086.8$$

$$T_s = 7636.84.$$

and

$$T_L = MT_2 + BM = 2807.66 + 4870$$

$$T_L = 7677.66$$

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Lengths:

$$L_{small} = \frac{\pi R_{small} \alpha}{180} = \frac{\pi \times 7614 \times 50}{180}$$

$$L_{small} = 6641.1m$$

$$L_{large} = \frac{\pi R_{large} \beta}{180} = \frac{\pi\, 7714 \times 40}{180}$$

$$\Rightarrow \quad L_{large} = 5382.65m$$

To find chainage:

chainage of intersection point - T_s

$$T_1 = 7514 - 7636.84$$

$$\Rightarrow T_1 = -122.84$$

plus $L_s = -122.84 + 6641.1$

$$= 6518.26$$

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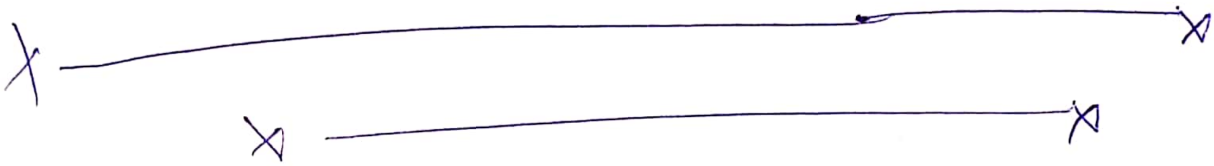
Chainage at $T_2 = T_1 + L_{large}$

$= 6518.26 + 5382.65$

$= 11900.91$



THE END.