(1st) BE-sem-IV-civil-CBSGS-SUR-II 17/5/18

Q. P. Code: 26090

(3 hours) [Total Marks-80]

N.B. (1) Question no. 1 is compulsory
(2)Attempt any three questions out of remaining five questions
(3) Assume any additional data, if necessary, and state it clearly
(4) Explain answers with neat sketches, wherever necessary

1. a) Explain the procedure for setting out centre line of a tunnel [05]
   b) Discuss necessity of curves. Classify horizontal curve with neat sketches. [05]
   c) Differentiate between fixed hair and movable hair method of tacheometry [05]
   d) What do you understand by Remote Sensing? Give its applications. [05]

2. a) Compare Radial Contouring Project with Block Contouring Project w.r.t the type of terrain, instruments and accessories used, time required, accuracy obtained, area covered, table for recording data, etc. [10]
   b) A simple curve, of radius of curvature 250 m, connects two straights, intersecting at 900 m chainage and an intersection angle of 34°30'. A chain of length 20 m is used. Calculate all necessary data for setting out half of the curve by perpendicular offsets from the back tangent [10]

3. a) The readings given below were made with a tacheometric theodolite having a multiplying constant of 100 and no additive constant. The reduced level at station A was 100.0 m and the height of the instrument axis 1.35 m above the ground. Calculate the gradient expressed as the horizontal distance one meter rise or fall vertically between the stations B and C. [10]

Station	To	WCB	Vertical angle	Stadia readings
A	B	48° 00'	+11° 30'	2.048, 1.524, 1.000
	C	138° 00'	-17° 00'	2.112, 1.356, 0.600

   b) Explain how do you perform project/ route survey for a highway [10]

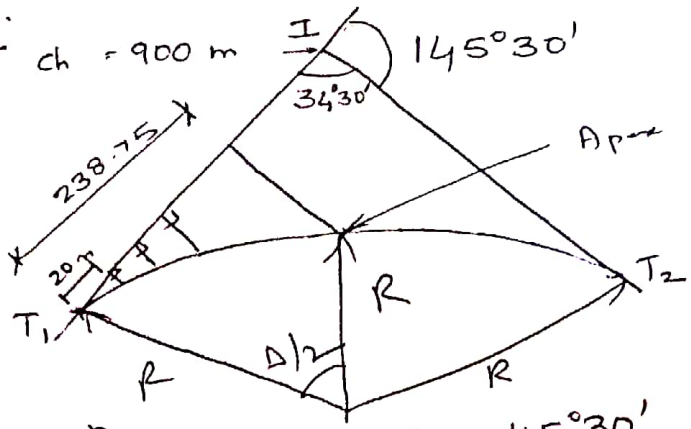
4. a) The stadia hairs of a tacheometer are separated by a distance of 1.15 mm. from the central hair. The focal length of the object glass of the telescope is 23 cm. The distance of the object glass from the trunnion axis is 7 cm. Calculate the tacheometric constants [05]
   b) What do you understand by Stadia Charts and Tacheometric Tables [05]
   c) Discuss briefly about the Global Positioning System. [05]
   d) Discuss the principle and applications of Electronic Distance Measuring Instruments [05]

5. a) A gradient of -1% meets a gradient of +2% at a chainage of 1110.00 and elevation of 335.75 m.; The vertical curve of length 140 m is to be set out with pegs at 10 m interval. Calculate the elevations of the pegs by the method of Tangent Correction [10]
   b) Explain the problems encountered while setting out simple circular curve [05]
   c) A railway curve is to be connected through a transition curve to a straight for a limiting velocity of 80 kmph. Calculate the length of the transition curve if superelevation is to be built up 0.025 m. per sec. of vehicular travel [05]

6. Write short notes on: **(any 4)** [20]
   a) Composite Curve
   b) Instruments for setting out works
   c) Subtense bar
   d) GIS
   e) Total Station

Q2 b.

Soln



$R = 250\ m$, $\Delta = 145°30'$

$\therefore T_1I = R\tan\frac{\Delta}{2} = 250 \tan\frac{145°30'}{2}$

$= 805.13\ m$

$\therefore$ Ch. of $T_1 = 900 - 805.13$

$= 94.87\ m$

Maximum offset to be set

$R\sin\frac{\Delta}{2} = 250 \sin\frac{145°30'}{2} = 238.75\ m$

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

$\therefore O_{20} = 250 - \sqrt{250^2 - 20^2}$

$= 0.801\ m$

$O_{40} = 3.220\ m$

$O_{60} = 7.306\ m$

$O_{80} = 13.146\ m$

$O_{100} = 20.871\ m$

$O_{120} = 30.683\ m$

$O_{140} = 42.877\ m$

$O_{160} = 59.906\ m$

$O_{180} = 76.506\ m$

$O_{200} = 100\ m$

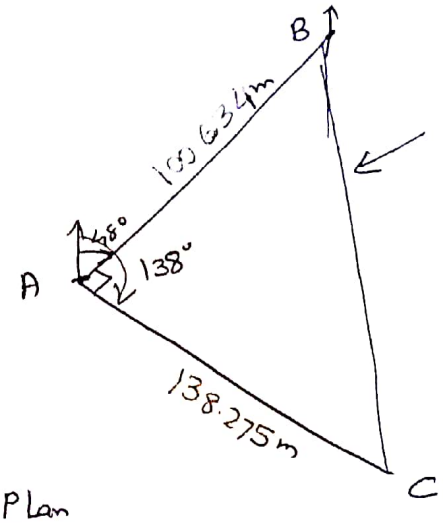
$O_{220} = 131.256\ m$

$O_{238.75} = 175.849\ m$

The other half of the curve can similarly be set as it is symmetrical.

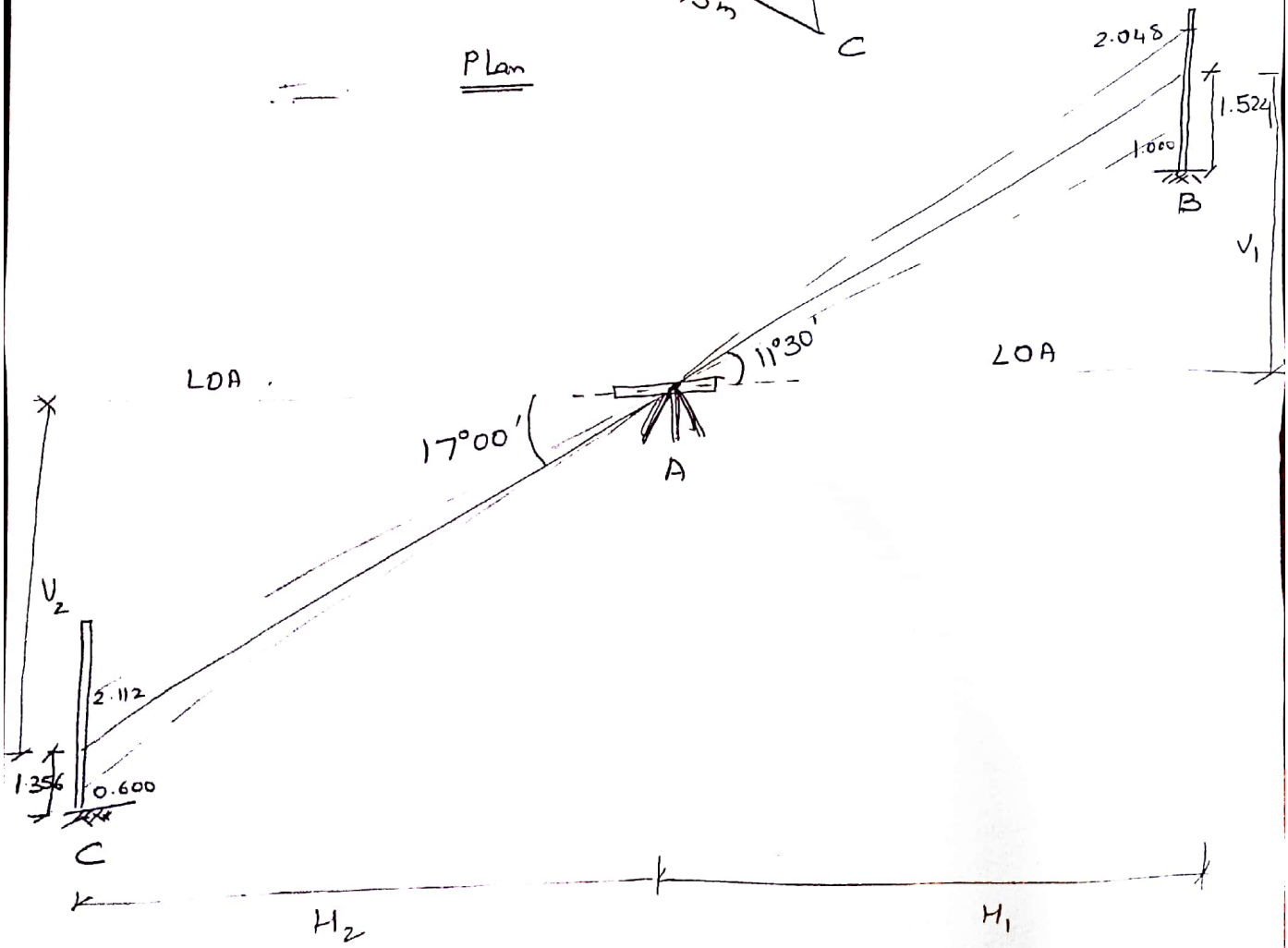
Q3 a Soln: k = 100, c = 0

RL A = 100 m.



∠BAC = 90°

Plan



$H_1 = ks_1\cos^2\theta_1 + c\cos\theta_1 = 100(\cos 11°30')^2(1.048) + 0$

$= 100.634\ m$

$H_2 = ks_2\cos^2\theta_2 + c\cos\theta_2 = 100(\cos 17°)^2(1.512) + 0$

$= 138.275\ m$

$\therefore H = \sqrt{H_1^2 + H_2^2} = \sqrt{100.634^2 + 138.275^2}$

$\boxed{H = 171.018\ m}$

$V_1 = \frac{k s_1 \sin 2\theta_1}{2} + c \sin\theta_1 = \frac{100(1048)\sin 23^\circ + 0}{2}$

$= 20.474\ m$

$V_2 = \frac{k s_2 \sin 2\theta_2}{2} + c \sin\theta_2 = \frac{100(1.512)\sin 34 + 0}{2}$

$= 42.275 m$

$\therefore V = V_1 + V_2 = 20.474 + 42.275$

$= 62.749$

$\therefore$ Gradient $= \frac{V}{H} = \frac{62.749}{171.018}$

$=$ 1 in 2.725 (falling gradient from B to C)

Q4 a

Soln

$i = 1.15\ mm \times 2 = 2.3\ mm$

$f = 23\ cm = 230\ mm$

$d = 7\ cm = 70\ mm$

$\therefore$ Multiplying constant $(k) = \frac{f}{i} = \frac{230}{2.3} = 100$

Additive constant $(c) = f + d$

$= 0.23 + 0.07$

$= 0.3\ m$

$\therefore$ $k = 100,\ c = 0.3$

Qs a

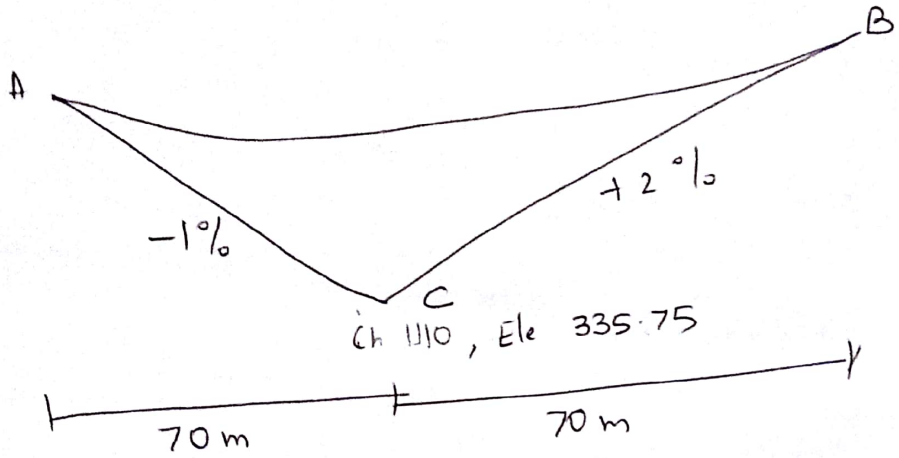
Total no. of station @ 10 m peg interval

$= \frac{140}{10} = 14$

∴ No. of stns to each side of apex, $n = 7$

$e_1 = \frac{g_1}{100} \times 10 = \frac{-1}{100} \times 10 = -0.1$

$e_2 = \frac{g_2}{100} \times 10 = \frac{2}{100} \times 10 = +0.2$



Elevation of pt. of intersection (C) = 335.75 m

∴ Elevation @ commencement of curve (A)

$= 335.75 - ne_1$

$= 335.75 - 7(-0.1)$

$= \underline{336.45\ m}$

Elevation @ end of curve (B)

$= 335.75 + ne_2$

$= 335.75 + 7(0.2)$

$= \underline{337.15\ m}$

The tangent correction w.r.t the 1st tangent,

$h = kN^2$

$k = \frac{e_1 - e_2}{4n} = \frac{-0.10 - 0.20}{4 \times 7} = -0.0107$

∴ $h = -0.0107\ N^2$

... contd.

∴ Chainage of Pt A = 1110 − 70
= 1040 m

Chainage of pt B = 1110 + 70
= 1180 m

→ Tangent elevation for 1st pt = 336.45 − 0.1
= 336.35

Tangent correction, h_1 = $-0.0107(1)^2$
= −0.0107 m

∴ Elevation of 1st pt = 336.35 − (−0.0107)
= 336.468 m

→ Tangent elevation for 2nd pt = 336.35 − 0.1
= 336.25

Tangent correction, h_2 = $-0.0107(2)^2$
= −0.0428

∴ Elevation of 2nd pt = 336.293 m

→ Tangent correction for 3rd pt = $-0.0107(3)^2$

$h_3 = -0.0963$ m

→ $h_4 = -0.1712$ m

→ $h_5 = -0.2675$ m

→ $h_6 = -0.3852$ m

→ $h_7 = -0.5243$ m

→ $h_8 = -0.6848$ m

→ $h_9 = -0.8667$ m

→ $h_{10} = 1.07$ m

→ $h_{11} = 1.2947$ m

→ $h_{12} = 1.5408$ m

→ $h_{13} = 1.8083$ m

→ $h_{14} = 2.0972$ m

Check Elevation of curve @ B

= 337.15 m

Elevation of curve @ B by tangent correction

= 336.45 - 14X01 + 2.0972

= 337.1472 ≈ 337.15 m

Hence checked

Stn	Chainage	Tangent elevation	Tangent correction (+ve)	Elevation of curve	Remarks
A	1040	336.45	0	336.45	
1	1050	336.35	0.0107	336.36	
2	1060	336.25	0.0428	336.35	
3	1070	336.15	0.0963	336.32	
4	1080	336.05	0.1712	336.32	
5	1090	335.95	0.2675	336.24	→ Vertex of curve
6	1100	335.85	0.3852	336.24	
7(c)	1110	335.75	0.5243	336.27	
8	1120	335.65	0.6848	336.33	
9	1130	335.55	0.8667	336.42	
10	1140	335.45	1.07	336.52	
11	1150	335.35	1.2947	336.64	
12	1160	335.25	1.5408	336.79	
13	1170	335.15	1.8083	336.96	
14(B)	1180	335.05	2.0972	337.15	

Q5c **Soln**: In case of railways the maximum superelevation should not exceed 15 cm

$\therefore h = 15$ cm, $x = 0.025$ m/sec $= 2.5$ cm/sec

$V = 80$ kmph $= \frac{80 \times 1000}{60 \times 60} = 22.22$ m/sec

$L = \frac{hV}{x} = \frac{15 \times 22.22}{2.5} = 133.33$ m

∴ Length of the transition curve = 133.33 m ... Ans