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| Course Title: Surveying | Course Code: CE 105 |
| Time : 3 Hours | Full Marks: 150 |

### There are **SEVEN** questions. Answer any **SIX.**

1. (a) Write down the correction and its nature due to earth's curvature and refraction. Explain how the procedure of reciprocal leveling eliminates the effects of atmospheric refraction and earth's curvature.     (3+4)

    (b) Define (i) Bench Mark (ii) Datum (iii) Elevation (iv) Turning Point     (4)

    (c) The following consecutive readings were taken with a level     (14)
6.21, 4.92, 6.55, 8.42, 9.80, 6.67, 7.91, 10.21, 8.22, 7.0 , 7.45
The level was shifted after $4^{th}$, $7^{th}$ and $9^{th}$ readings. The reduced level at first point was 100 ft. Calculate the reduced levels of the points by using Height of Instrument Method and apply necessary checks.

2. (a) Write down the errors associated with compass surveying. Adjust a "closing error" by any method in a close traverse survey with proper example.     (2+6)

    (b) Mention the guidelines of filling a "Field Book". What is contour?     (3+2)

    (c) An excavation is to be made for a reservoir 20 m long and 12 m wide at the bottom, having side of the excavation slope at 2 horizontal to 1 vertical. Calculate the volume of excavation if the depth is 4 metres. The ground surface is level before excavation.     (12)

3. (a) What are the instruments used in chain surveying?     (3)

    (b) How is a chain survey executed in the field?     (8)

    (c) A series of offsets were taken from a chain line to a curved boundary line at intervals of 60 feet in the following     (14)
0, 2.65, 3.80, 3.70, 4.65, 3.60 meters
Compute the area between the chain line, the curved boundary and the end offsets by
i)Trapezoidal Rule    ii) Simpson's Rule

4. (a) What is meant by shift of a curve? Derive an expression for the same.     (2+6)

    (b) Write down the characteristics of transition curve.     (2)

    (c) Two tangents intersect at chainage 75+75, the deflection angle being 60° 30′. Calculate the necessary data for setting out a curve of 40 chain radius to connect the two tangents, if it is intended to set out the curve by offset from chords. Consider peg interval equals to 100 links, length of the chain being equal to 20 m (100 links).     (15)

5. (a) A street bend which deflects 60°50′ is to be designed for a maximum speed of 150 Km/h, a maximum centrifugal ratio of 1/6 and a maximum change of acceleration of 35 cm/sec³, the curve consisting of a circular arc combined with two transition curves. Calculate a) the radius of the circular arc b) length of transition curve c) total length of the composition curve d) the chainage of the beginning and the end of the transition curve and e) the junctions of the transition curves with the circular arc if the chainage of the P.I is 4500 metres (16)

(b) Three points A, B and C were photographed and their co-ordinates with respect to the lines joining the collimation marks on the photograph are given in the table below. The focal length of the lens is 75 mm. Determine the azimuths of the line OB and OC, if that of OA is 355° 30′.The axis of the camera was level at the time of the exposure at the station O. (9)

| Point | X | Y |
|-------|-----------|-----------|
| a | -45.52 mm | - 21.43 mm |
| b | + 9.48 mm | -16.38 mm |
| c | + 48.26 mm | + 36.67 mm |

6. (a) Define (i) Crab (ii) Drift (iii) Over Lapping (6)

(b) A camera having focal length of 20 cm is used to take a vertical photograph to a terrain having an average elevation of 2000 m. What is the height above mean sea level at which an aircraft must fly in order to get the photograph at a scale of 1: 6000? (9)

(c) Find the distance between two places P and Q along the parallel of latitude, given that latitudes of P and Q are 27° 0′ N and their longitudes are 110° 0′ E and 131° 27′ W respectively. (10)

7. (a) Define (i) Celestial Poles and Celestial Equator (ii) Celestial Horizon (iii) Zenith and Nadir. Draw necessary sketches. (9)

(b) Find the shortest distance between two places S and T, given that the latitude of S and T are 40° 10′ N and 32° 20′ N and their longitudes are 50° 20′ E and 55° 28′ E respectively. Find also the direction of S on the great circle route. (16)

### Given formula:

1. $T = R\tan\dfrac{\Delta}{2}$,   $l = \dfrac{\pi R\Delta}{180°}$,   $\delta = 1718.9\dfrac{c}{R}$

2. $O_1 = \dfrac{c^2}{2R}$,   $O_2 = \dfrac{C}{2R}(c+C)$,   $O_3 = \ldots\ldots = O_{n-1} = \dfrac{C^2}{R}$,   $O_n = \dfrac{c'}{2R}(C+c')$

3. $L_{transition} = \dfrac{v^3}{\alpha R}$,   $\Delta_s = 1719\dfrac{L}{R}$,   $\Delta_c = \Delta - 2\Delta_s$,   $L_{circular} = \dfrac{\pi R\Delta_c}{180°}$,   $s = \dfrac{L^2}{24R}$,

$\tan\theta = \dfrac{v^2}{gR}$

4. $T = (R+s)\tan\Delta + \dfrac{L}{2}$

5. $s_h = \dfrac{f}{H-h}$,   $L = (1-p_l)sl$,   $W = (1-p_w)sw$

6. $a = L \times W$,   $N = \dfrac{A}{a}$

7. $N_1 = \dfrac{L_1}{(1-p_l)sl} + 1$,   $N_2 = \dfrac{L_2}{(1-p_w)sw} + 1$

8. $\tan\alpha_a = \dfrac{x_a}{f}$

9. $\tan\alpha_b = \dfrac{x_b}{f}$

10. Level Section        A = (b + nh) h

11. Two-Level Section    A = {n (b/2)$^2$+ m$^2$ (b+nh)h}/(m$^2$–n$^2$)

12. Three-Level Section  A = {b (h$_1$+h$_2$)/4 + h (w$_1$+w$_2$)/2}

$w_i$= m$_i$n/(m$_i$–n) (h+b/2n)
$h_1$= m$_1$n/(m$_1$–n) (h+b/2m$_1$)
$h_2$= m$_2$n/(m$_2$–n) (h–b/2m$_2$)

13. $V = \dfrac{d}{6}(A_1 + A_2 + 4A_m)$

14. $\cos P = \dfrac{\cos p - \cos a * \cos b}{\sin a * \sin b}$

15. $\tan(A+B)/2 = \cot(P/2) * \dfrac{\cos(a-b)/2}{\cos(a+b)/2}$

16. $\tan(A-B)/2 = \cot(P/2) * \dfrac{\sin(a-b)/2}{\sin(a+b)/2}$

**Note:** Here the symbols have their usual meanings.