



NOTE: Answer Four Questions only

Q1)

(25Marks)

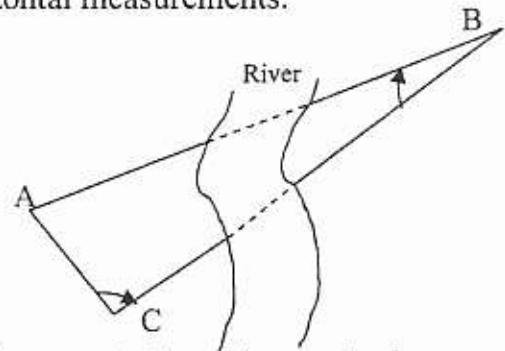
For the purpose of measuring the horizontal distance [AB] shown in the figure below, a (30 m) steel tape were used to take the following horizontal measurements.

$D_{AC} = 52.035 \text{ m}, 52.120 \text{ m}, 52.085 \text{ m}, 51.960 \text{ m}$

Angle C = $115^\circ \pm 1'$

Angle B = $32^\circ \pm 00''$

If the actual length of the tape = 30.020 m.



- Compute the most probable value of the horizontal distance (AC) and its standard error.
- Compute the horizontal distance (AB) and its standard error.

Q2)

(25 Marks)

- A. For the purpose of establishing new bench mark (A), the difference in height between point (A) and points (BM1, BM2, BM3) has been measured and the results are as follows:

Route	From	To	ΔZ m	Number of Level Setups	Elevation m
R1	BM1	A	5.492	17	BM1 = 42.093
R2	BM2	A	7.440	9	BM2 = 40.143
R3	BM3	A	23.480	10	BM3 = 24.102

Compute the most probable value of the elevation of point (A) and its standard error.

- B. The table below represents the field data of profile leveling using the level along the center line of a road. Compute the amount of cut or fill in all road center line stations.

Station	B.S m	F.S m	I.F.S m	Ground Elevation m	Grade Elevation m
BM1	1.789			33.889	
0+00			2.477		34.00
1+00			2.654		
1+25			1.634		
2+00			1.325		
2+50			1.444		33.00
BM2		0.798		34.880	

Q3)

A. The table below represents the field measurements of a traverse using theodolite and tape:

Theodolite station	Observed station	Telescope D or R	H.C.R	Horizontal Distance (m)
B	K	D	0°00'00"	450
	C	D	95°09'30"	
C	B	D	30°00'00"	800
	E	D	180°56'17"	

Knowing that; $X_B=2080.000\text{ m}$, $Y_B=5409.615\text{ m}$,

Azimuth of the line $\overline{KB} = AZ_{KB} = 30^\circ$.

1. Compute the horizontal angles to the right and the deflection angles (KBC, BCE) **(4 Marks)**
2. Compute the horizontal (X, Y) coordinates of points [C, E]. **(11 Marks)**

B. The following table represent the field data for topographic surveying using theodolite and leveling rod :

Theodolite station	Observed station	V.C.R	Rod Reading (m)			Elevation (m)
			U	M	L	
B	A	84°35'45"	1.700	1.350	1.000	32.520
	C	274°24'45"	---	0.500	---	?
		276°18'15"	---	2.200	---	

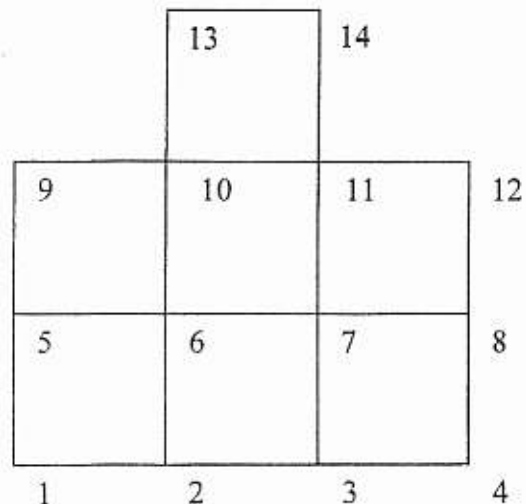
Compute the elevation of point [C].

(10 Marks)

Q4)

A. The following table represents the horizontal (X, Y) coordinates and the ground elevation (Z) for the points of the grid shown in the figure below:

Point	X (m)	Y (m)	Z (m)
1	0	0	70.373
2	20	0	71.051
3	40	0	71.679
4	60	0	72.421
5	0	20	70.432
6	20	20	70.691
7	40	20	71.483
8	60	20	73.735
9	0	40	70.584
10	20	40	71.758
11	40	40	72.321
12	60	40	73.975
13	20	60	72.951
14	40	60	73.531



- a. List the contour lines that pass through the grid using contour interval = 0.5m. (4 Marks)
- b. Compute the final elevation of the horizontal plane at which the volume of cut = volume of fill. (8 Marks)

B. The table below represent the final cross sections for a road having bed width (b=12.0 m).

Station	Cross-Section					Area [Cut (m ²)]	Area [Fill (m ²)]
	Left	C.L.			Right		
37+60						65.48	0.0
38+10	$\frac{f2.8}{14.4}$	$\frac{f3.2}{5.0}$	$\frac{0.0}{0.0}$	$\frac{C3.4}{4.0}$	$\frac{C2.6}{11.2}$?	
38+35						0.0	12.5

- a. Computes area of cut only at station 38+10 by coordinate method. (5 Marks)
- b. Compute volumes of cut only from station 37+60 to station 38+35 using End Area Method. (8 Marks)

Q5)

- A. In a simple circular horizontal curve the deflection angle (θ) = 33° , radius of the curve R = 175 m, Point of Intersection (P.I.) = Station (P.I.) = 30+78.
 Compute the incremental chords and the deflection angles required for laying out the curve by theodolite and tape using [1/2] [half] station. (15 Marks)
- B. A symmetrical parabolic vertical curve having length L = 300 m, if the gradient of the two tangent $g_1 = +3\%$, $g_2 = -2\%$ and the elevation of the Vertex (V) = (Z_v) = 98 m.
 Compute the elevation of the highest (lowest) point on the curve. (10 Marks)