KATHMANDU UNIVERSITY
End Semester Examination
February, 2025

Level : B.E.
Year : III
Time : 2 hrs. 30mins.

23 FEB 2025

Course : GEOM 307
Semester : II
F. M. : 40

SECTION "B"
[6 Q. × 5 = 30 marks]

Attempt ALL questions. Assume suitable data when necessary.

1. In a triangle ABC, the side AB has been measured on the field with the value of 320 ± 0.02 m. Similarly, the two adjacent angles A and B were also measured in order to determine the lengths of the two other sides. Angle A measures $70^0 30' \pm 20''$ and angle B measures $60^0 10' \pm 40''$. Compute the angle C along with the sides a and b along with their standard error.

2. Find the most probable values of the angles A, B and C from the following observations at a station P.

$A = 38^0\ 25'\ 20''\ weight = 1, \qquad B = 32^0\ 36'\ 12''\ weight = 1$

$A + B = 71^0\ 01'\ 29''\ weight = 2,$

$A + B + C = 119^0\ 10'\ 43''\ weight = 1$

$B + C = 80'\ 45'\ 28''\ weight = 2$

3. Coordinate transformation is a crucial process in surveying applications that involves integrating datasets from various reference systems, which includes different parameters. Discuss the role of factors like scale, rotation, and translation in the coordinate transformation procedure. Furthermore, clarify the significance of having redundant control points in ensuring the accuracy and reliability of the transformation.

4. The table below provides the coordinates of three points A, B and C in arbitrary coordinate system. The coordinates of points A and B are also provided in state plane coordinate system. Determine the coordinate of point C in state plane coordinate system applying the 2D conformal coordinate transformation.

Point	**State Plane Coordinates (m)**		**Arbitrary Coordinates (m)**	
	E	N	X	Y
A	588933.451	418953.421	5492.081	3218.679
B	588539.761	420185.869	6515.987	4009.588
C	?	?	4865.191	3649.031

P.T.O.

5. A baseline of calibrated length (μ) 100.0 m is measured 5 times. Each measurement is independent and made with the same precision. The sample mean $(\bar{x})$ and sample standard deviation (s) are calculated from the measurements:

$$\bar{x} = 100.5\, m;\ s = 0.05m.$$

Determine the 95% confidence interval for the population mean.

6. Derive the fundamental principle of least square for equal weight case.

SECTION "C"
[1 Q. × 10 = 10 marks]

Attempt ***ANY ONE*** question. Assume suitable data when necessary.

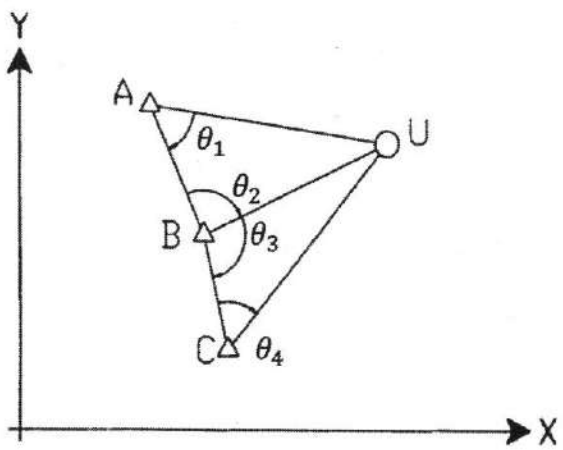
7. The four angles as shown in the figure below have been observed with the observations being of equal weight. Adjust the figure aside by least where the coordinates of the control points are given as following:

$\theta_1 = 50^0 06' 50''$, $\theta_2 = 101^0 30' 47''$

$\theta_3 = 98^0 41' 17''$, $\theta_4 = 59^0 17' 01''$

$X_a = 865.40$, $X_b = 2432.55$, $X_c = 2865.22$

$Y_a = 4527.15$, $Y_b = 2047.25$, $Y_c = 27.15$



8.

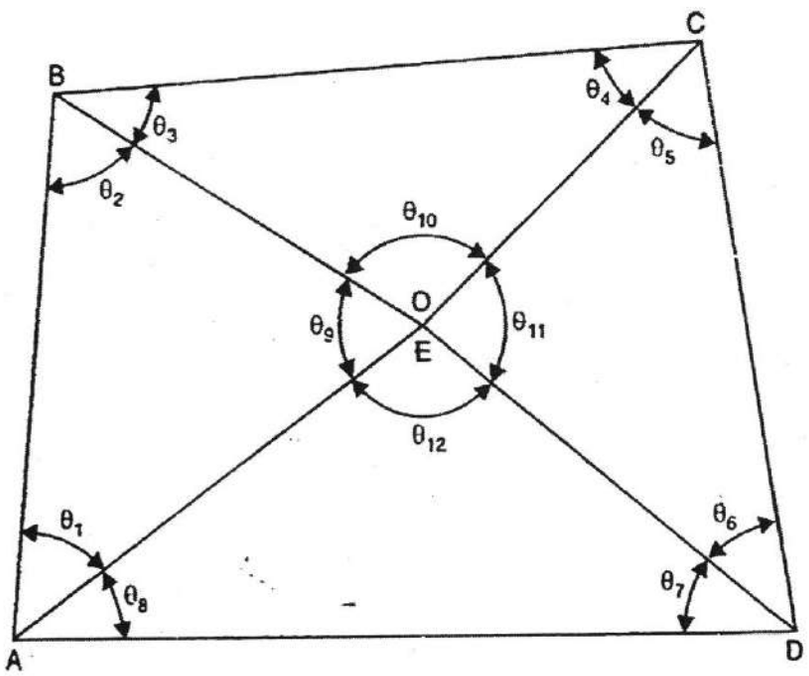
a. Figure below shows the quadrilateral ABCD with the central station E. Adjust the quadrilateral by approximate method if the angles are as provided below. [7]

$\theta_1 = 61^0 00' 54''$, $\theta_2 = 59^0 56' 06''$, $\theta_3 = 32^0 03' 54''$

$\theta_4 = 29^0 32' 06''$, $\theta_5 = 56^0 28' 01''$, $\theta_6 = 62^0 59' 49''$

$\theta_7 = 28^0 42' 00''$, $\theta_8 = 29^0 17' 00''$, $\theta_9 = 59^0 03' 10''$

$\theta_{10} = 118^0 23' 50''$, $\theta_{11} = 60^0 32' 05''$, $\theta_{12} = 122^0 00' 55''$



b. The standard error in a tape of 30 m tape length is ± 0.008m. A distance of 1200 m is to be taped. What is the expected 90% error in 1200 m? [3]

$\nu \downarrow$ \ $\alpha \rightarrow$	0.400	0.350	0.300	0.250	0.200	0.150	0.100	0.050	0.025	0.010	0.005	0.001	0.0005
1	0.325	0.510	0.727	1.000	1.376	1.963	3.078	6.314	12.705	31.816	63.639	318.20	636.18
2	0.289	0.445	0.617	0.816	1.061	1.386	1.886	2.920	4.303	6.964	9.925	22.401	31.579
3	0.277	0.424	0.584	0.765	0.978	1.250	1.638	2.353	3.183	4.541	5.842	10.216	12.954
4	0.271	0.414	0.569	0.741	0.941	1.190	1.533	2.132	2.776	3.748	4.604	6.897	8.610
5	0.267	0.408	0.559	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.895	6.880
6	0.265	0.404	0.553	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.708	5.208	5.961
7	0.263	0.402	0.549	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.500	4.785	5.408
8	0.262	0.399	0.546	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.356	4.510	5.041
9	0.261	0.398	0.543	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.304	4.781
10	0.260	0.397	0.542	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.149	4.605
11	0.260	0.396	0.540	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.029	4.452
12	0.259	0.395	0.539	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.933	4.329
13	0.259	0.394	0.538	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.854	4.230
14	0.258	0.393	0.537	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.789	4.148
15	0.258	0.393	0.536	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.734	4.079
16	0.258	0.392	0.535	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.688	4.021
17	0.257	0.392	0.534	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.647	3.970
18	0.257	0.392	0.534	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.611	3.926
19	0.257	0.391	0.533	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.580	3.887
20	0.257	0.391	0.533	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.553	3.853
21	0.257	0.391	0.532	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.528	3.822
22	0.256	0.390	0.532	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.506	3.795
23	0.256	0.390	0.532	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.486	3.770
24	0.256	0.390	0.531	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.748
25	0.256	0.390	0.531	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.451	3.727
26	0.256	0.390	0.531	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.708
27	0.256	0.389	0.531	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.691
28	0.256	0.389	0.530	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.409	3.675
29	0.256	0.389	0.530	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.397	3.661
30	0.256	0.389	0.530	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.647
35	0.255	0.388	0.529	0.682	0.852	1.052	1.306	1.690	2.030	2.438	2.724	3.340	3.592
40	0.255	0.388	0.529	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.552
60	0.254	0.387	0.527	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.461
120	0.254	0.386	0.526	0.677	0.845	1.041	1.289	1.658	1.980	2.358	2.617	3.160	3.374
∞	0.253	0.385	0.525	0.675	0.842	1.037	1.282	1.645	1.960	2.326	2.576	3.291	3.300