



GWANDA STATE UNIVERSITY

FACULTY OF ENGINEERING AND ENVIRONMENT

DEPARTMENT OF GEOMATICS AND SURVEYING

SURVEYING 2

ESG 2208

Examination Paper

April 2024

This examination paper consists of 6 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner: F. Shumba

INSTRUCTIONS

Calculator is required

Answer all questions

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QUESTION 1

Below are extract from a field book of a survey that was done as part of a control densification exercise.

The table below shows the coordinates of the trigonometrical beacons used in the survey

Trig Name	Easting	Northing	Elevation
Constant	-20,000.000	2,330,000.00	
1275/S	-20,568.29	6,992.99	980.560
1280/S	-35,441.92	42,782.87	1,056.45

@T1:12 Iron Peg-P		
1275/S		
T2	261.3959	-69.351, -69.353 -69.352 -69.352
T3	36.2112	-71.215 -71.215
RO	261.3957	
@ T2:12 mm Iron Peg-P		
T1	81.3958	
T4	328.4249	-174.223 -174.223
RO	81.3956	
@T4:12 mm Iron Peg-P		
T2	148.4245	
T5	259.2744	-120.690 -120.690
T8	103.1339	-155.138 -155.138
T6	322.2255	-115.660 -115.660
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T7	329.4237	-102.217
		-102.217

RO	148.4237	
@T6: 12 mm Iron Peg-P		
T4	142.2255	
T9	06.1847	-50.961 -50.962 -50.963 -50.963
RO	142.2253	
@T8:12 mm Iron Peg-P		
T4	283.1342	
T10	107.1540	-105.228 -105.228
RO	283.1342	
@T10:12 mm Iron Peg-P		
T8	287.1548	
T3	253.3727	-52.317 -52.317
RO	287.1545	
@T3:12 mm Iron Peg-P		
T10	73.3727	
T1	216.2054	
RO	73.3726	

@1275/S- Top Of Pillar			
	Face Left	Face Right	
1280/S	0.0002	179,5958	
T1	67.5423	247.5428	-1003.657 -1003.656 -1003.657
RO	359.5956	180.0002	

- Calculate Join 1275/S – 1280/S? (4)
- Adjust the traverse; find the final adjusted Directions and Distance. (8)
- Calculate the final adjusted coordinates of all the points in the traverse? (8)
- Calculate the Vector misclosure of the traverse? (5)

Please Note: - Use the traverse field book extract **ABOVE**

QUESTION 2

Modern total stations supply horizontal distance (D) and vertical height (δH) at the press of a button.

- What corrections must be applied to the initial field data of slope distance and vertical angle to obtain the best possible values for D and δH ? (4)
- When using EDM equipment of a particular make, why is it inadvisable to use reflectors from other makes of instrument? (3)
- To obtain the zero error of a particular EDM instrument, a base line AD is split into three sections AB,

BC and CD and measured in the following combinations:

$$AB = 20.512, AC = 63.192, AD = 153.303$$

$$BC = 42.690, BD = 132.803, CD = 90.1201$$

Using all possible combinations, compute the zero error. (8)

Manufacturers specify the accuracy of EDM equipment as $\pm a \pm bx$ mm where b is in ppm of the distance measured, x.

- d) Describe in detail the various errors defined by the variables a and b . Discuss the relative importance of a and b with regard to the majority of measurements taken in engineering surveys. (10)

QUESTION 3

- a) Explain in detail the three axis of a Total Station, the relationship between the axis and the errors associated with them? (9)

b) @ T1 H_i : - 1.420m

T3 $55^\circ 48' 14''$

Zenithal Angle: $81^\circ 44' 26''$ Angle of elevation: $8^\circ 15' 34''$

@T2 H_i : 1.410m

T3 $66^\circ 39' 44''$

Zenithal Angle: $92^\circ 47' 09''$ Angle of elevation: $2^\circ 47' 09''$

T1	1032.454	1104.345	452.987
T2	995.978	921.546	478.895

Calculate the mean (X, Y, Z) Coordinates of T3? (16)

Question 4

- a) Using a well labeled diagram briefly describe the following terms
- i. Geoid
 - ii. Ellipsoid
 - iii. Geoid Undulation
 - iv. Deviation of the Vertical (16)
- b. With the aid of a well labeled diagram and relevant formulae describe and differentiate Ellipsoidal and Orthometric Heights? (9)

TOTAL 100 MARKS
