



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**
FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

DEPARTMENT OF LAND AND SPATIAL SCIENCES

QUALIFICATIONS: BACHELOR OF GEOMATICS and DIPLOMA IN GEOMATICS	
QUALIFICATIONS CODES: 07BGEO, 06DGEO	QUALIFICATION LEVEL: Level 7 - 07BGEO Level 6 - 06DGEO
COURSE NAME: Basic Surveying COURSE CODE: BSV521S	COURSE LEVEL: 5
DATE: July 2024	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

SECOND OPPORTUNITY/SUPPLEMENTARY EXAMINATION QUESTION PAPER	
EXAMINER:	Mr Frikkie Louw
MODERATOR:	Dr Joseph Odumosu

INSTRUCTIONS

1. You **MUST** answer **ALL QUESTIONS**
2. Write clearly and neatly.
3. Number the answers clearly.
4. Make sure your Student Number is on the EXAMINATION BOOK(s).
5. **MAKE SURE YOUR STUDENT NUMBER IS ON ALL THE DATA SHEETS AND THAT YOU SUBMIT THEM WITH YOUR EXAMINATION BOOK(S).**

PERMISSIBLE MATERIALS

1. Calculator, ruler, pen, pencil, and eraser.

THIS QUESTION PAPER CONSISTS OF 7 PAGES (Including this front page and 2 Data Sheets)

Question 1

- 1.1. List the **THREE** basic methods of determining a distance. (3)
- 1.2. There are **TWO PRINCIPAL CLASSIFICATIONS** of surveying. Name **BOTH** and explain them in detail. (6)
- 1.3. Describe how to detect the presence of parallax when looking through the telescope of an automatic level or a theodolite. Additionally, explain how to focus the crosshairs to eliminate parallax. (6)
- 1.4. Setting out involves using surveying equipment and techniques to transfer information from a plan to the ground. Describe the **THREE** distinct elements of setting out. (3)

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Question 2

- 2.1. Calculate oriented directions for the traverse by completing the direction sheet on Data Sheet 1. Use the said data sheet for all your calculations. Please detach the data sheet and submit it along with your examination booklet. (12)
- 2.2. Please calculate the final coordinates for the traverse points using the information provided in Data Sheet 2. Utilize the Bowditch Rule to adjust the traverse. Keep in mind that the directions are oriented, and the distances are the final horizontal distances. Please detach the data sheet and submit it along with your examination booklet. (13)

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Question 3

3.1. Use the following Formula and the observations at **P**, to answer the following questions.

$$\Delta H_{ab} = H_i - H_{sig} + S_{ab}/\tan(Z) + (1-k).S^2/(2R)$$

Where R is earth radius (use R = 6 365 km), and k is an assumed relative ray curvature factor (use k = 0.13).

$$H_a = H_b - \Delta H_{ab}$$

Co-ordinates

Name	Y	X	Z(Height)
Δ KWB	- 2 802.630	+ 68 240.850	1 998.700
P	- 9 887.578	+ 64 690.717	

@ P Height of Instrument is 1.690m

Name	Oriented Direction	Slope Distance	Zenith Angle	Height of Target
Δ KWB	63°23'10"		88°00'31"	1.210m
T1	85°34'33"	106.382	93°25'47"	1.495m

The Horizontal Distance P to Δ KWB is 7 924.600 metres.

Note: The Atmospheric Correction, the Conversion to German Legal Metre, and the Combined Sea level & Scale Enlargement Scale Factor correction is already applied to all measured distances.

3.1.1. Calculate the height of **P** (6)

3.1.2. Calculate the Y X Z co-ordinates for point **T1**. (10)

3.2. Point D is at a reduced distance of 1 120, 541 metres from A and on a direction which can be reduced from the following horizontal angular observations.

Calculate co-ordinates for **D**. (9)

Co-ordinates

Point	Y	X
A	-2 756.460	+18 445.000
Δ Bee	-1 961.570	+14 268.710
Δ Cee	-6 520.650	+18 443.800

<u>@ A</u>	Final Observed Direction
Δ Bee	169° 13' 00"
Δ Cee	269° 58' 18"
D	100° 19' 30"

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Question 4

- 4.1. Use the data below to calculate the co-ordinates for the point **RESEC**, using Collins Q-point method. (20)

Co-ordinate List.

Name	Y	X
FRIED	+ 16 946.030	+ 72 931.360
KOMAS	+ 36 118.900	+ 54 709.810
OTJOMPAU	+ 12 119.750	+ 59 781.720

Final Observed Directions.**@ RESEC**

Name	Fin. Observed Direction
FRIED	323° 29' 47"
OTJOMPAU	208° 43' 07" - Long Leg
KOMAS	100° 02' 11"

- 4.2. Use the information below to calculate co-ordinates for point **DRUM**. (12)

Please note:

The Atmospheric Correction and the Prism Constant Correction have already been applied to all measured distances.

Combined Sea level & Scale Enlargement Scale Factor = $1 + [(y^2)/(2R^2) - H/R]$

R = 6 370 000m and H = 1800.000m

Co-ordinates

Name	Y	X	Z
Δ Moltke	-18 508.640	+72 023.020	2481.600
ZB3214	-26 178.133	+60 627.395	

@ DRUM

HI = 1.655m

Point/Station	Fin. Observed Dir.	Slope Distance	Zenith Angle
Δ Moltke	29° 23' 01"		87°35'28"
ZB3214	110° 54' 10"	190.702m	91°07'32"

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Data Sheet 1

Question 2.1.

Direction Sheet

1	2	3	4	5	6	7
Station	Final Observed Direction	Incoming/ Back Direction	Prov. Correction	Outgoing/ Forward Direction	Join Diff. \ Final Correction	Join Direction / Final Oriented Direction
@ TSM 1						
Δ Kleine	310.18.35					<u>310.18.43</u>
Δ Win 3	70.14.20					<u>70.14.30</u>
ST 1	140.12.40					
@ ST 1						
TSM 1	320.12.50					
ST 2	165.17.53					
@ ST 2						
ST 1	345.17.37					
TSM 3	150.00.04					
@ TSM 3						
Δ Kleine	6.27.44					<u>6.27.56</u>
Δ Win 3	142.18.28					<u>142.18.46</u>
ST 2	330.00.20					

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Data Sheet 2

Question 2.2.

Bowditch Rule - Adjustment Sheet

Note: All answers must be rounded off to 3 decimal places (0.000)

DIR. / DIST	JOINS	DIFFERENCES		STATIO N	FINAL COORDINATES	
		dY	dX		Y	X
				RM100	- 2 196.470	+ 5 342.100
143° 40' 10"	Do NOT calculate Joins					
121.960m						
				C		
210° 16' 50"						
240.020m						
				D		
273° 51' 50"						
372.020m						
				E		
229° 36' 30"						
2373560m						
				RM101	- 2 797.850	+ 4 907.740

