



**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: June 2025	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY 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 9 PAGES (Including this front page and 3 Data Sheets)

Question 1

1.1. Answer the following questions by selecting the correct answer for each statement:

- 1.1.1. The process of measuring the relative positions of natural and man-made features on, above, or below the earth's surface, and presenting this information either graphically or numerically, is called:
- A Surveying
 - B Levelling
 - C Measuring
 - D Contouring
- 1.1.2. The type of surveying that considers the true shape of the Earth is:
- A Photogrammetry
 - B Geodetic Surveying
 - C Cartography
 - D Plane Surveying
- 1.1.3. What type of survey is conducted by a registered land surveyor or under their supervision in Namibia? This survey focuses on measuring land to prepare scaled plans and diagrams that show and define legal property boundaries, enabling ownership registration in the Deeds Office.
- A Topographic Surveying
 - B Hydrographic Surveying
 - C Cadastral Surveying
 - D Engineering Surveying
- 1.1.4. Which of the following levelling methods uses the principle that the difference in elevation between two points correlates with the difference in atmospheric pressure at those points?
- A Barometric levelling
 - B Trigonometric levelling
 - C Spirit levelling
 - D Traverse levelling

- 1.1.5. Which among the following is one of the principles of surveying?
- A Taking measurements
 - B Covering the entire area
 - C Determining the elevation differences
 - D Working from whole to part
- 1.1.6. Parallax can be eliminated by focusing the eye-piece and objective.
- A True
 - B False
 - C Maybe
 - D None of these
- 1.1.7. Close contours of decreasing values towards their centre, represents a
- A Hill
 - B Depression
 - C Saddle
 - D River bed
- 1.1.8. Contours of different elevations may cross each other only in the case of a
- A Overhanging cliff
 - B Vertical cliff
 - C Pass
 - D Valley
- 1.1.9. The reference object in angular observations must fulfill the following requirements:
- A It must be a well-defined point
 - B It must not be too close or too far
 - C It does not have to have co-ordinates
 - D All the above
- 1.1.10. A permanent reference point or mark, of known height above a datum, is called:
- A Reference point
 - B Benchmark
 - C Datum point
 - D Witness mark

(1 x 10) = (20)

- 1.2. Please utilize the levelling observations found on the levelling field sheet below to determine the final heights using any method that allows for a complete arithmetic check. Be sure to complete Data Sheet 1. All standard checks must be performed, and any misclosures should be adjusted accordingly. Note that the values in bold represent the inverted staff readings. Please detach the data sheet and submit it along with your examination booklet. (10)

Levelling field sheet

Point	B.S.	I.S.	F.S.	Final Heights
BM1-Roof	-0.802			1217.355
A		1.231		
B		1.207		
ROOF 2	-0.920		-0.838	
C		0.899		
D	0.975		0.966	
E		0.817		
BM3-Roof			-0.524	1217.016

- 1.3. Describe **ANY FIVE** characteristics of contours. (5)

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Question 2

- 2.1. Calculate the mean co-ordinates of point **INTER 1** using the information below. (15)

Co-ordinates

Point	Y	X	Description
Δ Pillar 1	- 8 183.882	+62 681.985	Concrete Pillar
K 1	- 8 136.154	+62 628.497	Hole in concrete
The Final Oriented Direction from Δ Pillar 1 to INTER 1			= 60° 38' 05"
The Final Horizontal Distance from K 1 to INTER 1			= 203.065m

- 2.2. Utilize the provided field book information below to calculate the final observed directions at point **R** (no orientation correction is needed). Please present the results in a column format. (5)

@R HI = 1.812m		
Point	Circle Left	Circle Right
Δ Draai	317° 16' 03"	137° 16' 05"
Δ Som	63° 23' 19"	243° 23' 23"
Δ Eis	180° 06' 02"	0° 05' 58"
Draad	309° 11' 03"	129° 11' 11"
RO	317° 16' 09"	137° 16' 15"

- 2.3. Utilize the information below to calculate the final vertical directions at point **K15**. Please present the results in a column format. (5)

@K15 HI = 1.655m		
Point	Circle Left	Circle Right
ΔCC	85° 03' 08"	274° 56' 58"
K2	92° 10' 37"	267° 49' 17"
Gate	94° 54' 05"	265° 05' 59"

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Question 3

- 3.1. 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. (12)
- 3.2. Calculate oriented directions for the traverse by completing the direction sheet on Data Sheet 3. Use the said data sheet for all your calculations. Please detach the data sheet and submit it along with your examination booklet. (13)

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Question 4

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

Co-ordinates

Name	Y	X
ΔKOBUS	+ 33 252.460	+ 182 505.030
ΔLEPEL	+ 53 689.320	+ 203 390.460
ΔSLAAI	+ 27 619.400	+ 194 045.970

@ Koppie

ΔSLAAI	270° 00' 01" - Long Leg
ΔLEPEL	46° 08' 52" - 1 st Leg
ΔKOBUS	157° 03' 18" - 2 nd Leg

- 4.2. Use the following Formula to calculate the height of **H1**. (5)

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

R = 6 370 000m) k = 0.13

Co-ordinates

Point	Y	X	Z
Δ EROS	-10 489.688	+60 272.255	1 810.685 (Ground Level)

The JOIN distance from H1 to Δ EROS is 4 104.000m

<u>@ H1</u>	HI = 1.780m	
Point	Zenith Angle	Height of Pillar
Δ EROS	87° 46' 45"	1.200m (Top of Pillar)

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Student Number _____

Data Sheet 1

Question 2.1.

Rise and Fall Levelling Sheet

NOTE: The BOLD values are the Inverted Staff Readings.								
Rounded off to the nearest 3 (0.000) decimal places.								
BM1-Roof	-0.802							1217.355
A		1.231						
B		1.207						
ROOF 2	-0.920		-0.838					
C		0.899						
D	0.975		0.966					
E		0.817						
BM3-Roof			-0.524					1217.016

Height of Collimation Levelling Sheet

NOTE: The BOLD values are the Inverted Staff Readings.								
Rounded off to the nearest 3 (0.000) decimal places.								
BM1-Roof	-0.802							1217.355
A		1.231						
B		1.207						
ROOF 2	-0.920		-0.838					
C		0.899						
D	0.975		0.966					
E		0.817						
BM3-Roof			-0.524					1217.016

Student Number _____

Data Sheet 2

Question 3.1.

Bowditch Adjustment Sheet

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

DIRECTION & DISTANCE	JOINS	DIFFERENCES		STATION	FINAL	COORDINATES
		ΔY	ΔX		Y	X
				A	-6 436.905	+ 62 908.098
155° 19' 55"	Do NOT Calculate Joins					
1 331.645m						
				B		
131° 59' 10"						
1 326.551m						
				C		
151° 32' 05"						
1 088.307m				D	-4 376.418	+ 59 853.774

Student Number _____

Data Sheet 3

Question 3.2

Direction Sheet

1	2	3	4	5	6	7
Station	Final Observed Direction	Incoming/ Back Direction	Prov. Correction	Outgoing/ Forward Direction	Final Correction	Join Direction / Final Oriented Direction
@ TSM						
Δ KLOOF	217° 06' 44"					<u>217° 06' 32"</u>
CON1	244° 18' 12"					
Δ TABLE	316° 51' 20"					<u>316° 51' 14"</u>
@ CON1						
CON2	283° 41' 35"					
TSM	64° 18' 30"					
@ CON2						
J78	261° 27' 40"					
CON1	103° 41' 23"					
@ J78						
Δ KLOOF	214° 20' 40"					<u>214° 20' 09"</u>
Δ TABLE	320° 22' 25"					<u>320° 21' 48"</u>
CON2	81° 28' 19"					

