



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

DEPARTMENT OF LAND AND SPATIAL SCIENCES

QUALIFICATION: BACHELOR OF QUANTITY SURVEYING, BACHELOR OF GEOINFORMATION TECHNOLOGY, BACHELOR OF LAND ADMINISTRATION, BACHELOR OF ARCHITECTURE, BACHELOR OF REGIONAL AND URBAN PLANNING, BACHELOR OF REGIONAL AND RURAL DEVELOPMENT	
QUALIFICATION CODE: 07BQOS, 07BGEI, 07BLAM, 07BARC, 07BURP, 07BROR	LEVEL: 5
COURSE: INTRODUCTION TO SURVEY AND MAPPING	COURSE CODE: ISM520S
SESSION: DECEMBER 2025	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

SECOND OPPORTUNITY / SUPPLEMENTARY EXAMINATION QUESTION PAPER

EXAMINERS: Ms D. Husselmann and Mr D. Vargas
MODERATOR: Mr F. Louw

THIS QUESTION PAPER CONSISTS OF 9 PAGES (Including this front page)

INSTRUCTIONS

1. Answer ALL the questions.
2. Write clearly and neatly.
3. Number the answers clearly.
4. Answers to calculations must be rounded off to three decimal places, excluding answers to co-ordinate conversions

PERMISSIBLE MATERIALS

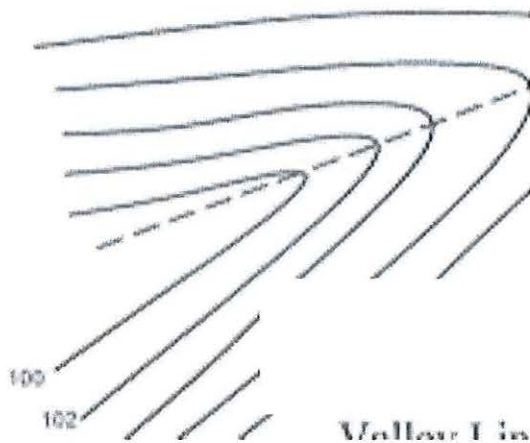
1. Calculators and other drawing equipment

Question 1

State whether the following are True or False.

(10)

- 1.1. Office work is the part of surveying when calculations and drawings are done in order to prepare for observations to be done.
- 1.2. A theodolite and total station can both measure angles.
- 1.3. A digital level only needs to be levelled approximately as it has a compensator inside the level that makes it exactly levelled.
- 1.4. On the Namibian LO co-ordinate system the false origin for Y is formed by the odd Latitudes.
- 1.5. When doing a taped measurement, if your tape is sagging, the measured distance will be longer.
- 1.6. Polars and joins can be considered the inverse of each other as with one co-ordinates are determined using distance and direction, and with the other distance and direction are determined using co-ordinates.
- 1.7. To check the accuracy of your traverse, one should start and end at a known point.
- 1.8. Horizontal setting out is the process whereby the Y, X and Z values are marked on the ground using values determined with the help of surveying software.
- 1.9. The Differential GNSS positioning technique is less accurate than autonomous GNSS positioning technique.
- 1.10. The picture below shows contour lines forming a vertical cliff.



[10]

Question 2

- 2.1. What do the following acronyms stand for? (3)
- GNSS
 - DOP
 - GLM
- 2.2. Differentiate between a map and a plan. (2)
- 2.3. Match the correct letters to the correct numbers, explaining what each mean. (3)

Word	Definition
A. Correction	1. Small discrepancy that remains after the correction has been applied to a reading.
B. Residual	2. Difference between a measured value and the true value of a reading or observation.
C. Error	3. Quantity that must be applied to the measured value to get the true value.

- 2.4. Name 2 different methods used to determine the position of a point. (2)
- 2.5. State the three basic principles that must always be applied during a levelling procedure. (3)
- 2.6. Draw and label the axes (orientation) of the Namibian LO coordinate system. Indicate the signs for both Y and X in each quadrant. (4)
- 2.7. What are the purposes of a Reference Object (R/O)? (3)
- 2.8. Explain why slope corrections must be applied to EDM measurements. (3)
- 2.9. List three of the corrections applied to electronic-measured distances. (3)

[26]

Question 3

- 3.1. What type of traverse needs to be performed in order to be able to check the accuracy of the traverse? (1)
- 3.2. Draw a table comparing an open traverse and a closed traverse. (2)
- 3.3. Describe the procedure for horizontal setting out of a feature such as a road or a pipeline or a building or an erf, etc. (3)
- 3.4. What is the difference between the Post-processing surveying and the Real Time Kinematic surveying styles. (4)
- 3.5. Contour Interval is the vertical distance between any two consecutive contours. The contour interval is kept the same on a map to depict correct topography of the terrain. The contour intervals on a map depend on certain factors; name ANY THREE of these factors. (4)

[14]

Question 4

Use the field observations below to answer the questions that follow.

@MAK2

HI= 1.653 m

HT= 2.000 m

Point	HA	SD	VA
BC13	123°50'55"		
DAV1	232°59'38"	50.000	92°23'29"
DAV2	131°44'27"	25.126	91°59'02"

Co-ordinates

Name	Y	X	Z
MAK2	- 7 089.900	+ 58 546.893	1670.456

4.1 Calculate the Co-ordinates of point DAV1 and indicate in which quadrant is point DAV1 located relative to the setup point (8)

4.2 Calculate the elevation of DAV2 by using trigonometrical heighting (3)

[11]

Question 5

A full Arc of Observations was carried out by a Land Surveyor: Calculate final observed directions given the following observations below. Complete Table 1 on Datasheet 1. (6)

@BASE1

Point	Circle Left	Circle Right
DAV1	131°16'20"	311°16'27"
a	207°52'49"	27°52'40"
b	253°26'32"	73°26'23"
RO	131°16'03"	311°16'13"

[6]

Question 6

A land surveyor oriented the instrument approximately 0° South and as we know the final observed direction cannot be used to calculate Y, X co-ordinate values. Therefore, Calculate the Oriented Direction from the instrument setup point STN1 to CW1 using the data below. Complete Table 2 on Datasheet 1. (11)

Show your join calculation.

Co-ordinates

	Y	X
STN1	-7 055.288	+58 496.435
STN2	-7 049.807	+58 510.903
BC11	-7 054.756	+58 510.629

@STN1

Point	Final Observed Direction
STN2	$20^\circ 42' 43''$
BC11	$02^\circ 06' 54''$
CW1	$26^\circ 22' 45''$

[11]

Question 7

Use the "Height of the Plane of Collimation" method to determine the final heights on Data sheet 2. (10)
All checks need to be shown and the correction needs to be distributed.

[10]

Question 8

A Data Traverse was done by a Land Surveyor to calculate co-ordinates of points missing on the data sheet of a General Plan. Calculate the data traverse using the Bowditch rule by completing the column form (Data sheet 3). (12)

[12]

Student Number:.....

Datasheet 1

QUESTION 5

Table 1: Final Observed Direction

@BASE1

Point	Circle Left	Circle Right	Mean	Correction	Final Observed Direction
DAV1	131°16'20"	311°16'27"			
a	207°52'49"	27°52'40"			
b	253°26'32"	73°26'23"			
RO	131°16'03"	311°16'13"			

QUESTION 6

Table 2: Oriented Direction

Point	Final Observed Direction	Join	Difference / Correction	Oriented Direction
STN2	20° 42' 43"			
BC11	02° 06' 30"			
CW1	26° 22' 45"			

Student Number:.....

Data Sheet 2

QUESTION 7

Data Sheet 2: Collimation Height Method

Point	Back Sight	Intermediate Sight	Fore Sight	HPC	Reduced Level	Correction	Adjusted Levels
BM1	1.580						100.000
1		1.568					
2		2.037					
3	1.813		1.602				
BM4			<u>1.563</u>				103.382

Student Number:.....

Data Sheet 3

QUESTION 8

Data Sheet 3: Bowditch Adjustment Sheet

Note: All answers must be rounded off to 3 decimal places.
The bold values are inverted staff readings.

Horizontal Direction & Horizontal Distance	Join	ΔY	ΔX	Point ID	Final Co-ordinates	
					Y	X
314° 32' 00" 300.040				RN8	-76681.080	-450725.850
43° 34' 20" 229.370				RN9		
43° 35' 30" 183.830				Rd32		
				RN13	-76610.110	-450216.110