



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

SECOND OPPORTUNITY / SUPPLEMENTARY EXAMINATION QUESTION PAPER

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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. Field 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 both measure distance and direction.
- 1.3. An automatic 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 22°S.
- 1.5. When applying more than the standard tension to taped distances, 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. A traverse should always start and end at the same 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. Differential GPS positioning technique is more accurate than autonomous GPS positioning technique.
- 1.10. The contour interval on a map can differ depending on the landform being shown.

[10]

Question 2

2.1. What do the following acronyms stand for? (3)

- a. MSL
- b. DOP
- c. GLm

2.2. Differentiate between a map and a plan. (2)

2.3. Match the correct letters to the correct numbers, defining each type of error. (3)

Error	Definition
A. Systematic Errors	1. Mistakes caused by negligence or carelessness.
B. Random Errors	2. Errors occurring due to flaws in instruments.
C. Gross Errors	3. Errors occurring due to limitations of instruments.

2.4. Name 2 different methods used to determine the position of a point. (2)

2.5. List three checks for blunders done during levelling calculation? (Write down the formulas) that should result in the same answer. (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 tape-measured distances. (3)

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Question 3

- 3.1. What is a traverse? (2)
- 3.2. Why is it necessary to run a traverse? (1)
- 3.3. Draw a table comparing an open traverse and a closed traverse. (2)
- 3.4. Describe the procedure for horizontal setting out of a feature such as a road or a pipeline or a building or an erf, etc. (4)
- 3.5. List two advantages and two disadvantages of using a GPS/GNSS. (1)
- 3.6. 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**

- 4.1 Given the field observations below and calculate the following:
- a) The Co-ordinates of point BC6 (7)
- b) The elevation of BC7 by using trigonometrical heighting (3)

@STN1**HI= 1.624****HT= 1.750**

Point	HA	SD	VA
BASE1	170° 18' 52"		
BC6	139° 57' 54"	21.886	86° 55' 19"
BC7	126° 34' 56"	25.771	87° 32' 16"
RO	170° 19' 13"		
Co-ordinates			
Name	Y	X	Z
STN1	- 4 117.683	+ 60 844.044	1700.432

- 4.2 A land Surveyor observed a full arc of observations as it can be seen below, calculate the final observed directions. Complete in column form using table 1 on data sheet 1. (7)

@P

Point	Circle Left	Circle Right
R	210° 12' 20	30° 12' 22"
A	279° 18' 24"	99° 18' 21"
B	305° 11' 04"	125° 11' 06"
C	55° 14' 18"	235° 14' 19"
RO	210° 12' 24"	30° 12' 21"

- 4.3 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 RM1 to MAK1 using the data below and by completing table 2 on data sheet 1. Secondly, use the Oriented Direction to calculate the co-ordinates of Point MAK1 by polar. The horizontal distance from RM1 to MAK1 is 532.125m. (12)

Co-ordinates

	Y	X
RM1	-4 109.945	+60 798.677
STN1	-4 117.683	+60 844.044
STN2	-4 092.943	+60 808.576

@RM1

Point	Final Observed Direction
STN1	345°08'54"
STN2	54°37'02"
MAK1	50°29'39"

- 4.4 The levelling field observations on Data Sheet 2 were carried out by a Land Surveyor at a construction site. Reduce the data sheet using the "HPC Method" to determine the final heights. All checks need to be shown and the correction needs to be correctly distributed. (12)

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Question 5

- 5.1 Calculate the field traverse using the Bowditch rule by completing the column form on data sheet 3. Calculate the linear accuracy and accuracy of the traverse at the end. (9)

[9]

Student Number _____

Data Sheet 1

Question 4.2Table 1: Final Observed Direction

@P

Point	Circle Left	Circle Right	Mean	Correction	Final Observed Direction
R	210° 12' 20"	30° 12' 22"			
A	279° 18' 24"	99° 18' 21"			
B	305° 11' 04"	125° 11' 06"			
C	55° 14' 18"	235° 14' 19"			
RO	210° 12' 24"	30° 12' 21"			

Question 4.3Table 2: Oriented Direction

Point	Final Observed Direction	Join	Difference / Correction	Oriented Direction
STN1	345° 08' 54"			
STN2	54° 37' 02"			
MAK1	50° 29' 39"			

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Data Sheet 2

Question 4.4HPC Method

The Underlined bold readings are inverted staff reading

Point	Back Sight	Intermediate Sight	Fore Sight	HPC	Reduced Level	Correction	Adjusted Levels
BM1	3.565						1296.475
1	2.190		1.513				
2		<u>3.025</u>					
3		2.079					
4	3.015		1.548				
5		1.859					
6		3.263					
BM2			0.655				1301.565

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Data Sheet 3

Question 5.1Bowditch Adjustment Sheet

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

Horizontal Direction & Horizontal Distance	Join	ΔY	ΔX	Point ID	Final Co-ordinates	
					Y	X
117°13'10" 52.240				C10	+2 064.280	+45 046.190
222° 29' 30" 102.540				C2		
				C1	+2 041.480	44 946.690

