



PAMIBIA 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: NOVEMBER 2025	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER

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

THIS QUESTION PAPER CONSISTS OF 11 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

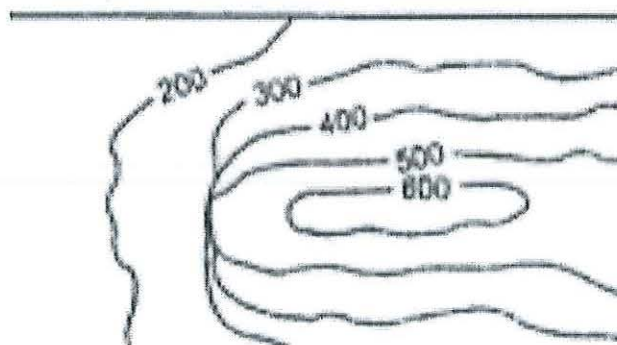
Answer the following questions by selecting the correct statement for each:

(10)

- 1.1. The position of a point may be determined by a variety of methods. Which of these methods uses angles to determine the position of a point?
- Triangulation
 - Trilateration
 - Polar
 - Traverses
- 1.2. Which of the following instruments are used to determine the y and x position of a point accurately?
- Level
 - Measuring tape
 - Theodolite
 - Total station
- 1.3. Which of these levels read a bar-coded staff using electronic laser methods?
- Dumpy level
 - Automatic level
 - Tilting level
 - Digital level
- 1.4. Projection panels for the Namibian LO co-ordinate system is _____ wide.
- 1 degrees
 - 2 degrees
 - 3 degrees
 - 4 degrees
- 1.5. One of these corrections are applied to both electronic measured and taped distances:
- Slope Corrections
 - Standard Tension
 - Conversion to German legal Meter
 - Standard Temperature

- 1.6. Which of these is a method used to determine the horizontal distance and direction?
- Polar
 - Join
 - Traverses
 - Trilateration
- 1.7. A traverse that starts and ends at the same known point is known as a:
- Link traverse
 - Loop traverse
 - Open traverse
 - Normal traverse
- 1.8. Which of these describes setting out?
- Transferring positional values from plans to the ground
 - Transferring positional values from ground to plans
 - Determining positional values using survey software
 - Comparing measured and calculated values
- 1.9. GNSS stands for:
- Global Navigation Space Satellites
 - Global Navigation Space Systems
 - Geographic Navigation Satellite Systems
 - Global Navigation Satellite Systems

- 1.10. The picture below represents which natural feature?



- a. Ridge
- b. Valley
- c. Vertical cliff
- d. Pond

[10]

Question 2

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

- a. RTK
- b. MSL
- c. EDM

2.2. Match the correct letters to the correct numbers, explaining what each mean. (5)

Branch of Surveying	Definition
A. Cadastral Surveys	1. Surveys concerned with the measurements and mapping of natural and artificial features of the earth, like hills, lakes, rivers, roads, railways, power lines, etc.
B. Topographic Surveys	2. Determining the directions and dimensions of tunnels. Or Maintaining the relationship between the above ground and the underground workings. Or Measurement of excavation volumes. Or Calculation of the ORE reserves.
C. Engineering Surveys	3. Surveys dealing with bodies of water, e.g. water areas, volumes, levels, rate of flow and the shape of under water surfaces.
D. Mining Surveys	4. Surveys performed by a registered Land Surveyor or under his/her supervision in Namibia, concerned with the measurement of land for the preparation of plans and diagrams, drawn to scale, showing and defining legal property boundaries in order that

	ownership may be registered in the Deeds Office.
E. Hydrographical Surveys	5. Surveys concerned with the planning, design and placing of pegs in the field of engineering works, such as roads, railways, dams, canals, tunnels, services in townships, etc.

- 2.3. Name the type of errors as listed below, stating the letter and what error it is (3)

Letter	Definition
A.	Errors occurring due to flaws in instruments. These errors follow a pattern. Most are eliminated by adopting responsible observation strategies like taking mean observations, repeat observation etc.
B.	blunders / mistakes – caused by negligence or carelessness, e.g. misreading an instrument.
C.	Errors occurring due to limitations of instruments. These are errors left after gross and systematic errors have been removed.

- 2.4. List three checks for blunders done during levelling calculation? (Write down the formulas) that should result in the same answer. (3)
- 2.5. Draw a sketch indicating the directions of increase and decrease for the co-ordinate values on the Namibian LO Co-ordinate System for both Y and X. (4)
- 2.6. What are the requirements of a Reference Object? (3)
- 2.7. List three different methods of determining distance. (3)

[24]

Question 3

- 3.1. Name the type of traverse that a) starts and ends at a known point whether it be the same known point or two different known points and b) the traverse that starts at a known point and ends at an unknown point. (2)
- 3.2. Why is it necessary to run a traverse? (1)

- 3.3. Complete the sentence: To check the accuracy of your traverse, you need to end your traverse at a _____ point. (1)
- 3.4. Draw a table to differentiate between horizontal setting out and vertical setting out. (2)
- 3.5. What is the most accurate method for vertical setting out? (1)
- 3.6. List two advantages and two disadvantages of using a GNSS. (4)
- 3.7. Briefly describe ANY FIVE characteristics of Contours. (5)

[16]

Question 4

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

@MAK1

HI= 1.542 m

HT= 1.500 m

Point	HA	SD	VA
Eros	225°10'30"		
Mun	309°21'10"		
6799b	137°45'23"	43.234	86°56'10"
6799c	138°35'50"	41.674	87°12'30"

Co-ordinates

Name	Y	X	Z
MAK1	- 4 087.567	+ 60 807.441	1759.500

- 4.1 Calculate the Co-ordinates of point 6799b and indicate in which quadrant is point 6799b located relative to the setup point (8)
- 4.2 Calculate the elevation of 6799c by using trigonometrical heighting (3)

[11]

Question 5

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

@BASE1

Point	Circle Left	Circle Right
DAV1	121°06'10"	301°06'17"
a	197°42'39"	377°42'30"
b	243°16'22"	63°16'13"
RO	121°06'05"	301°06'15"

[6]

Question 6

A land surveyor oriented the instrument approximately 0° South and as we know the final observed (11) 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 Data Sheet 1.

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° 42' 43"
BC11	02° 06' 54"
CW1	26° 22' 45"

[11]

Question 7

Use the "RISE and FALL" method to determine the final heights on Data sheet 2. All checks need to be shown and the correction needs to be distributed. (11)

[11]

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 on Data sheet 3). (12)

[12]

Student Number:.....

Datasheet1

QUESTION 5

Table 1: Final Observed Direction

@BASE1

Point	Circle Left	Circle Right	Mean	Correction	Final Observed Direction
DAV1	121°06'10"	301°06'17"			
a	197°42'39"	377°42'30"			
b	243°16'22"	63°16'13"			
RO	121°06'05"	301°06'15"			

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: Rise and Fall Method

Point	Back Sight	Intermediate Sight	Fore Sight	Rise	Fall	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	Final Co-ordinates	
				ID	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