NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

**FACULTY OF NATURAL RESOURCES AND SPATIAL SCIENCES**

**DEPARTMENT OF GEO-SPATIAL SCIENCES AND TECHNOLOGY**

| **QUALIFICATIONS:**<br>DIPLOMA IN GEOMATICS<br>BACHELOR OF GEOMATICS | |
|---|---|
| **QUALIFICATIONS CODES:**<br>06DGEM<br>07BGEM | **COURSE LEVEL:**<br>Level 5 |
| **COURSE CODE:** BSV521S | **COURSE NAME:** Basic Surveying |
| **SESSION:** January 2020 | **PAPER:** Theory |
| **DURATION:** 3 HOURS | **MARKS: 100** |

| **SECOND OPPORTUNITY/SUPPLEMENTARY EXAMINATION QUESTION PAPER** | |
|---|---|
| **EXAMINER:** | **Mr F. J. Louw** |
| **MODERATOR:** | **Mr S. E. Sinvula** |

**INSTRUCTIONS**

1. You **MUST** answer **ALL** the 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, pencil and eraser.

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

## Question 1

1.1. Explain the following with neat sketches:

1.1.1. The three methods to measure a distance using a measuring tape. (6)

1.1.2. Precise observations and accurate observations. (4)

1.1.3. Indicating the directions of increasing and decreasing of the co-ordinate values for both Y and X for the Namibian coordinate systems. (4)

1.2. Briefly describe ANY FOUR characteristics of Contours. (4)

1.3. Why should intermediate sights onto important points be avoided in levelling? (2)

**[20]**

---

## Question 2

2.1. Calculate the traverse on Data Sheet 1. Use the said Data Sheet for all your calculations. Use the Bowditch Rule to adjust the traverse. Please note that the directions are oriented, and the distances are final. (10)

2.2. Calculate oriented directions for the traverse by completing the direction sheet on Data Sheet 2. Use the said Data Sheet for all your calculations. (10)

**[20]**

---

**Question 3**

Calculate the Y X Z co-ordinates for point ST101, by using the following information and the observations at ST101. (22)

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

Where R is earth radius (use R = 6 370 km), and k is an assumed relative ray curvature factor (use k = 0.13).

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

**Please note:**

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

**Co-ordinates**

| Name | Y | X | Z | Description |
|---|---|---|---|---|
| ΔTare | +101 871.540 | +27 439.710 | 1685.150 | Top of Pillar |
| WP1 | +101 456.605 | +32 040.196 | | Working Station |

**@ ST101** Height of Instrument is 1.785m

| Point | Fin. Observed Dir. | Slope Distance | Zenith Angle | Height Target |
|---|---|---|---|---|
| ΔTare | 163°31'26" | | 88°02'50" | 0.000m |
| WP1 | 359°58'55" | 376.252m | 91°15'27" | 2.055m |

**[22]**

## Question 4

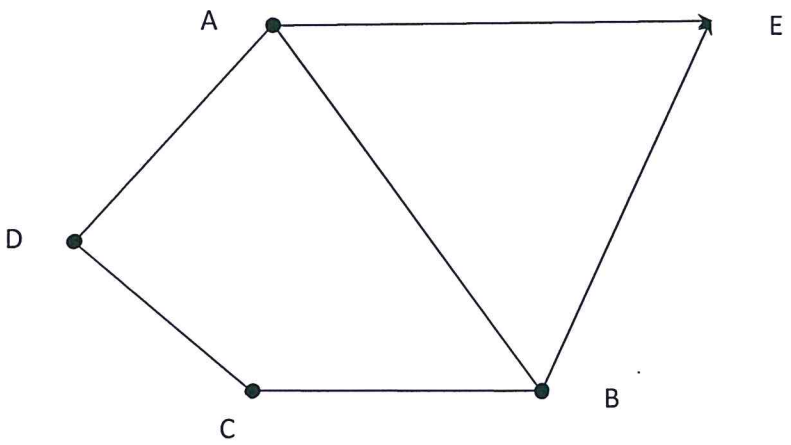
It is required to enlarge a mining area by adjusting the north-eastern boundary line A B up to point E. Use the figure below and the data to calculate the mean co-ordinates for point E (You have to calculate two sets of co-ordinates for point E and get the mean). (18)

**Co-ordinates**

| **Name** | **Y** | **X** |
|---|---|---|
| A | – 7 942.216 | + 232 724.615 |
| B | – 8 325.739 | + 233 049.448 |
| C | – 8 075.898 | + 233 145.585 |
| D | – 7 813.534 | + 233 033.430 |

True Direction A to E = 263° 05' 53"

True Direction B to E = 185° 55' 14"




**[18]**

**Question 5**

5.1. Calculate the co-ordinates of point **TOP** by using Collins Q-point method. Use the observations below that were done to three trigonometrical beacons. (20)

**Co-ordinates**

| **Name** | **Y** | **X** |
|---|---|---|
| Δ DRAAI | - 271 14.600 | + 154 255.400 |
| Δ NAB | - 35 842.500 | + 153 064.100 |
| Δ SES | - 29 097.400 | + 171 069.100 |

**@ TOP** Height of Instrument = 1.719m

| Name | Fin. Observed Dir. | |
|---|---|---|
| Δ DRAAI | 147° 16' 05" | |
| Δ NAB | 253° 23' 23" | |
| Δ SES | 10° 05' 58" | Long Leg |

**[20]**

**Student Number:** _____ **Data Sheet 1**

**Question 2.1**

**Bowditch Rule - Adjustment Sheet**

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

| DIRECTION & DISTANCE | JOINS | DIFFERENCES | | STATION | FINAL COORDINATES | |
|---|---|---|---|---|---|---|
| | | ΔY | ΔX | | Y | X |
| | | | | **TSM1** | **-8102.407** | **62542.287** |
| 81° 42' 31" | Do NOT Calculate Joins | | | | | |
| 205.118m | | | | | | |
| | | | | Trav1 | | |
| 87° 48' 18" | | | | | | |
| 203.515m | | | | | | |
| | | | | Trav2 | | |
| 61° 47' 54" | | | | | | |
| 160.935m | | | | | | |
| | | | | **TSM2** | **-7 554.223** | **62 655.709** |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**Student Number: _____** **Data Sheet 2**

**Question 2.2**

**Direction Sheet**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Station | Final Observed Direction | Incoming/ Back Direction | Prov. Correction | Outgoing/ Forward Direction | Final Correction | Final Direction (Join Direction / Final Oriented Direction) |
| | | | | | | |
| @ RM10 | | | | | | |
| ΔTrig 1 | 78° 32' 48" | | | | | **78° 32' 28"** |
| ΔTrig 2 | 236° 15' 40" | | | | | **236° 15' 26"** |
| A | 241° 48' 00" | | | | | |
| | | | | | | |
| @A | | | | | | |
| RM10 | 61° 47' 34" | | | | | |
| B | 267° 47' 50" | | | | | |
| | | | | | | |
| @B | | | | | | |
| A | 87° 48' 08" | | | | | |
| RM11 | 261° 42' 20" | | | | | |
| | | | | | | |
| @ RM11 | | | | | | |
| ΔTrig 100 | 309° 39' 50" | | | | | **309° 40' 12"** |
| B | 81° 42' 05" | | | | | |
| ΔTrig200 | 285° 56' 10" | | | | | **285° 56' 31"** |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |