



**UNIVERSITY OF SWAZILAND  
FINAL EXAMINATION PAPER**

**PROGRAMME: BSC AGRICULTURAL AND BIOSYSTEMS  
ENGINEERING (ABE) II**

**COURSE CODE: ABE 204**

**TITLE OF PAPER: LAND SURVEYING**

**TIME ALLOWED: TWO (2) HOURS**

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER  
QUESTIONS.**

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GRANTED BY THE CHIEF INVIGILATOR**

## SECTION I: COMPULSARY

## QUESTION ONE

- A) A small scale farmer in the **Middleveld of Swaziland** was advised to grow **green mealies** to increase his cash flow. However, he had to determine his **field size** and consequently the **plant population**. The **Extension Officer** advised that he could use an old bicycle wheel to measure his field size, but it had to be calibrated (**Table 1**).

Table 1. Bicycle wheel calibration for linear field measurements in the Middleveld.

No. of Times Measurement was made (x)	Length (Revolutions)
1	1.6
2	1.5
3	1.3
<b>Total</b>	<b>4.4</b>

Upon calibration the field was measured and its dimensions were recorded as reflected in **Table 2**.

Table 2. Bicycle wheel measured green mealies field dimensions

Field Dimension	Length (Revolutions)
AB	67.0
BC	70.0
CD	67.0
DA	70.0

- i. What is the **Land Surveying** technical name given to this linear measurement technique? **(1 mark)**
- ii. What was the **circumference** of the bicycle wheel after calibration? **(3 marks)**
- iii. Calculate the **area** of the field in **m<sup>2</sup>** and **hectares (ha)**. **(3 marks)**
- iv. If the spacing of maize was **60 cm between rows** and **30 cm between plants**, what was the plant population going to be? **(4 marks)**

- B) i. Which other Land Surveying linear measurement technique could have been used by the farmer with limited resources, particularly equipment, but with relatively good results? **(1 mark)**
- ii. Discuss briefly how this land surveying technique could be used for linear measurements. **(5 marks)**
- C) i. What are the **three (3)** methods of contouring? **(3 marks)**
- ii. A topographic survey of Neverland, a development site in Terrabethea with dimensions of **60 m x 40 m** was conducted by a surveyor named Gustavo in April 1959 (**Figure 1**). This was done in an attempt to provide useful information for planning purposes. To do this a contour plan of the area had to be drawn.
- ii. Draw a contour plan of Neverland on **Figure 1** shown of the **following page** using a contour interval of 10 m. The contour plan should have a **border line** and a **title box** with all the technical information that ought to be there. The **grid north** could be assumed for this contour plan. **(15 marks)**
- iii. The developer was advised to provide storm water drainage for the top left part of the development site. Prove by calculation that this was an accurate recommendation. **(5 marks)**

**[40 marks]**

600 ●

780 ●

● 950

700 ●

750 ●

● 850

680 ●

720 ●

● 830

550 ●

710 ●

● 750

## SECTION B: ANSWER ANY TWO QUESTIONS

## QUESTION TWO

- A) State the instruments or techniques that are used in direct distance measurements as well as in **optical distance measurements**. (5 marks)
- B) Describe with the aid of a diagram how the **electromagnetic distance measurement (EDM)** instruments operate. (14 marks)
- C) i. Name any three methods of linear measurements used in land surveying. (6 marks)
- ii. A surveyor measured the length of a dam flood spillway using a dumpy level. During measurement the upper stadia reading was recorded in the field book as **3.850 m**, while the lower one was **1.450 m**. Calculate the length of the flood spillway length. (5 marks)
- [30 marks]

## QUESTION THREE

- A) Discuss in **detail** the land surveying process stating the **three stages involved**. The discussion should state the examples of land surveying techniques which could utilize the process when making measurements of the earth's features. (15 marks)
- B) i. State how you would correct **systematic errors** for **lengths and areas** brought about by **damaged chains**. (7 marks)
- ii. Given that the calculated area on a map of scale **1:1000**, was **3000 cm<sup>2</sup>** and that the lengths were measured using a chain that was **0.4%** too short. Calculate the true area and the percentage error of the area. Please show all your work. (8 marks)
- [30 marks]

## QUESTION FOUR

- A) Name any **three (3)** methods of computing **areas** from **maps** other than the **Simpson's and Trapezoidal's Rules**. **(6 marks)**
- B) The following chain surveying data were recorded in the field when chaining and measuring off-sets of a proposed road or track from a near-by embankment (**Table 3**). Compute the area between the road and the embankment using the Simpson's rule. **(12 marks)**

Table 3. Embankment chaining field data.

Station	A	B	C	D	E	F	G	H	I	J	K	L
Chainage (m)	0	15	30	45	60	75	90	105	120	135	150	165
Offset (m)	6.3	4.2	3.8	2.1	8.2	9.3	6.7	4.6	3.2	1.2	0.2	1.0

- C) The Kwaluseni Campus of the **University of Swaziland** uses floor bench marks. The **Multi-Purpose Hall (MPH)** floor bench mark is **653.80 m AOD** and the Chapel or Religious centre bench mark is **654.20 m AOD**.
- Calculate the height difference between the chapel and the MPH? **(6 marks)**
  - If the average distance between the MPH and the chapel is **500 m**, calculate the slope between the two locations. **(6 marks)**
- [30 marks]**