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**UNIVERSITY OF ESWATINI
FINAL EXAMINATION PAPER**

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

COURSE CODE: ABE 207

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 land surveying student went for **Field Attachment** as part of his **training internship** to get practical skills at a sugarcane company in the **Lowveld** of Swaziland. He was assigned to advise small scale farmers that were getting technical advice from the company about the importance of field measurement and its applications in agriculture. As part of the assignment, the student demonstrated the use of pacing, a linear measurement method that is always available, provided the **pace factor** is known. The demonstration meant he had to establish his pace factor with farmers, where a **known distance** of **20.0 m** was measured and then paced (**Table 1**). **Calculate** the pace factor of the student.

(4 marks)

Table 1. Pace factor establishment.

Pacing runs (x)	Distance (Paces)
1	34
2	37
3	39
4	40
5	43
Total	193

B) i. Calculate the **dimensions** in **meters (m)** and the **area** in **hectares (ha)** of the maize field which was measured as reflected in **Table 2**. **(10 marks)**

Table 2. Field measurement by pacing

Dimension	Length (Paces)
AB	300
BC	200
CD	300
DA	200

- ii. The dimensions of the maize field could have been measured accurately and faster with an electromagnetic distance measurement (EDM). The EDM utilizes **equation 1** to determine the distance in question.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \quad (1)$$

Given that the speed was **100 m/s** and it took **9.5 seconds** for the signal to be returned to the **emitter**, calculate the **distance** that was **measured** by the EDM.

(5 marks)

- C) i. If the student in (A) had to use a **bicycle wheel odometer**, explain what he/she was supposed to do before using it. (2 marks)
- ii. Discuss briefly how the **bicycle wheel** or **fabricated odometer** could be used for linear measurement in land surveying. (9 marks)
- D) Describe the **land surveying process** stating the three (3) stages involved. (10 marks)

[40 marks]

SECTION II: ANSWER ANY TWO QUESTIONS

QUESTION TWO

- A) i. What are the **two methods** that are used for **booking** levelling data in land surveying? (2 marks)
- ii. What are the **four (4)** surveyor's level cross hairs or **stadia** that are used in levelling? (4 marks)
- iii. Which two of these **stadia** are used for **distance measurement**? (2 marks)

- iv. A land surveyor measured the length of a **dam spillway** using a surveyor's level. Calculate the **length** of the dam spillway, if the telescope reading of the levelling staff was as reflected in **Figure 1**. (2 marks)

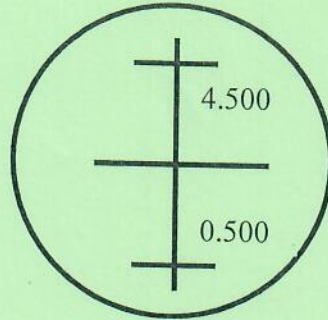


Figure 1. Surveyor's level telescopic reading of the levelling staff

- B) Complete the booking of the levelling data shown in **Table 3**. (10 marks)
- C) i. What is the other method of height measurement other than the clinometer? (2 marks)
- ii. A land surveyor with an **eyesight height (h)** of 1.7 m took position at a survey station site 50.0 m away from a **tree**, whose height he was **measuring**. He used a **clinometer** to measure the height of the tree, whose **angle of elevation** was 10° . Calculate the **height** of the **tree**. (4 marks)
- iii. Briefly **describe** how a **clinometer** could be used to **measure the height** of a known object. (4 marks)
- [30 marks]

Examination NO.:

Table 3. Road section; Cardiff hall
and the Education Centre: rise and fall method

Name of Surveyor: Mr. Vusi Msimango

Name and Location of Site: Road section between Cardiff hall and the Education Centre. UNESWA, Luyengo Campus.

Date: August, 2007

Instrument Type and NO.: Dumpy Level, A405

Weather: Partly cloudy.

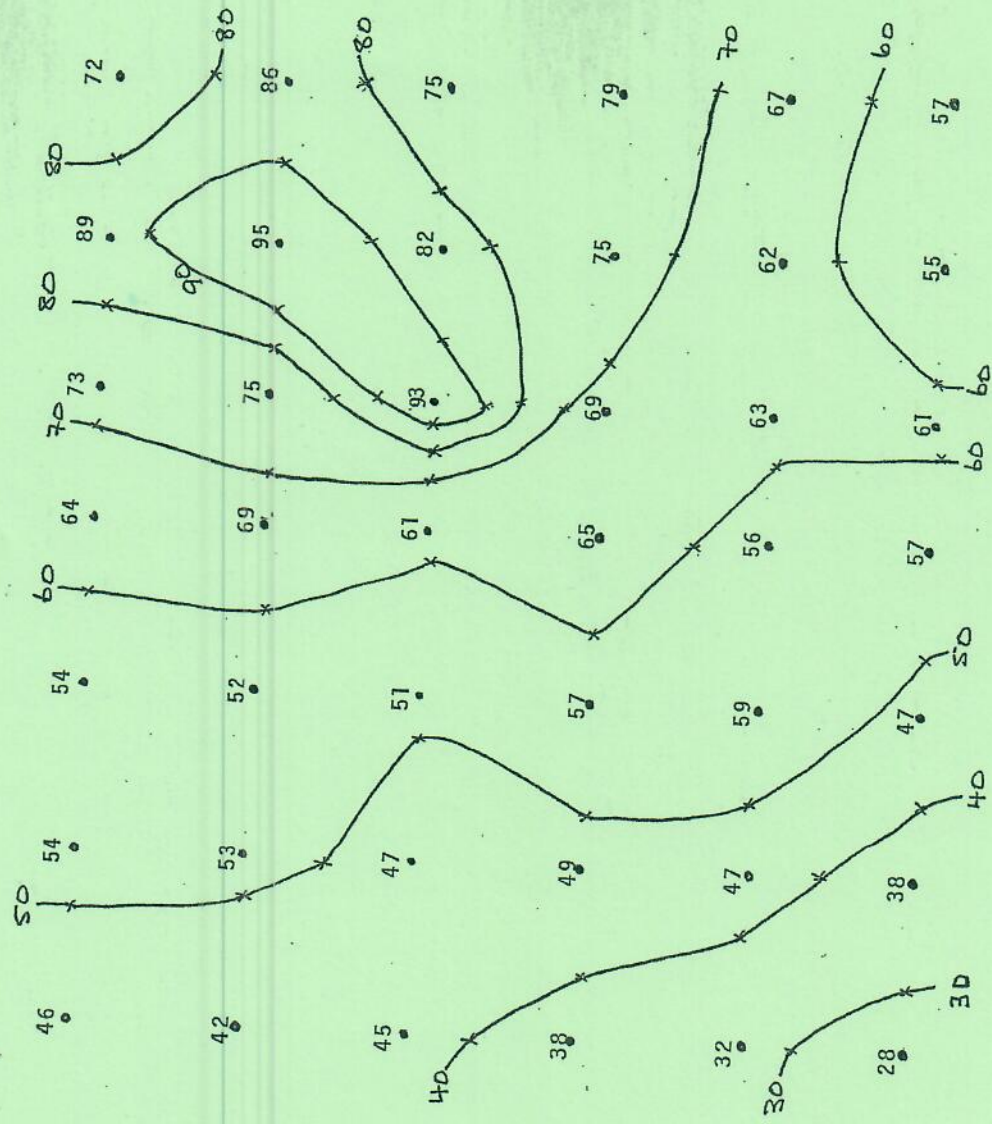
Back Sight	Intermediate Sight	Fore Sight	Rise	Fall	Reduced Level	Distance (m)	Remarks
0.450					730.000	0	BM 730.00 m AOD
	1.720			1.270	728.730	20.000	Staff Station A
	1.850			0.130		40.000	Staff Station B
	1.980			0.130	728.470	60.000	Staff Station C
1.450		2.090		0.110	728.360	80.000	Change Point @ staff station D Road section – Cardiff Hall
	1.680			0.230		100.000	Staff station E - Road
	1.855					120.000	Staff station F - Road
	2.040			0.185		140.000	Staff station G - Road
0.965		1.555	0.485		728.255	160.000	Change point at staff station H
	1.205			0.240	728.015	180.000	Staff station I- Road
	1.495			0.290	727.725	200.000	Staff station J - Road
	1.775			0.280	727.445	220.000	Staff station K - Road
	2.030				727.190	240.000	Staff station L - Road
	2.150				727.070	260.000	Staff station M - Road
		2.050	0.100		727.170		Staff station N. End of levelling - Education Centre.
2.865		5.695	0.585	3.415	727.170		
5.695			3.415		730.000		
2.830			2.830		2.830		

QUESTION THREE

- A)
 - i. What are the other **two (2)** methods of **contouring** besides the grid method? (2 marks)
 - ii. **Discuss in detail** how a **topographic survey** of a selected **agricultural land site** could be conducted using the **grid method**. (10 marks)

 - B) The following **contour map** of a section of **Neverland, in Terrabethea** was surveyed by **Nosihle Kunene** in **September, 1953**. She was in the process of drawing the contour plan or map when priorities changed and it was thus left **incomplete**. **Complete the contour map**, clearly reflecting the following:
 - i. Boarder line.
 - ii. Title box (complete with all the expected information).
 - iii. North. (9 marks)

 - C)
 - i. Define the term **offset** as used in chain surveying. (1 mark)
 - ii. What are the **three (3)** methods of offset identification, location and measurement that are used in chain surveying? (3 marks)
 - iii. Which of these methods is used for both offset position identification and position location? (1 mark)
 - iv. In an effort to determine the accuracy of measurement a land surveyor measured an offset that was **30 m x 40 m**. Calculate what the **check length** was supposed to be if the measurement was accurate. (4 marks)
- [30 marks]**



QUESTION FOUR

- A) i. What are the **three (3)** methods of **slope measurement**? **(3 marks)**
- ii. An arable small community **vegetable crop** development site was identified using a topographic map where it was found to lie between contour lines **44.400 m** and **42.000 m**. The horizontal distance between the contour lines in question was found to be **15 cm**. Calculate the slope of the development site if its map was eventually drawn using a scale of **1: 1000**. **(5 marks)**
- iii. In your opinion, was the development site suitable for arable crop farming? **(2 marks)**
- B) i. What are the **three (3)** methods of computing areas from maps other than the Simpson and **Trapezoidal's rule**? **(3 marks)**
- ii. The following chain surveying data were recorded in the field when chaining and measuring off-sets of a proposed road or track from a nearby embankment (**Table 3**). Compute the area between the road and the embankment using the **Trapezoidal's rule**. **(5 marks)**

Table 3. Embankment chaining field data.

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

- C) i. What are the **two (2)** methods of **height measurement** other than the **clinometer**? **(2 marks)**
- ii. A **land surveyor** with an eyesight **height (h)** of **1.7 m** took position at a survey site **50.0 m** away from the **tree**, whose **height** he was measuring. He used a clinometer to measure the height of the tree, whose angle of elevation was **10°**. Calculate the **height** of the **tree**. **(4 marks)**
- ii. Discuss briefly how a clinometer could be used to measure the height of a known vertical object in **land surveying**. **(6 marks)**
- [30 marks]**