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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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SECTION I: COMPULSARY

QUESTION ONE

A) An **Extension Officer** was asked by a **small scale farmer** to measure the **dimensions** of his maize field. This was to be done in an effort to determine the potential **plant population** of the maize crop. The farmer had an old discarded **bicycle wheel,** which could be used for measurement, but he did not know how.

i. If the **Extension Officer** had to use the **bicycle wheel** odometer what was he supposed to do prior to measurement? **(2 marks)**

ii. Discuss in detail how the **bicycle wheel** or **fabricated odometer** could be used for measurement in land surveying. **(9 marks)**

(B) 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 as a linear measurement that is always available, provided the pace factor is known. The demonstration meant he had to establish his pace factor with farmers, where a 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

(C) **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.

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

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)

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 **Figure1**. **(2 marks)**

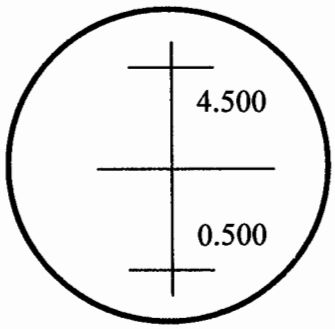


Figure 1. Surveyor's level telescopic reading of the levelling staff

B) Complete the booking of the levelling data shown in Table 1. **(10 marks)**

Examination N0.:.....

Table 1. 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. UNISWA, Luyengo.

Date: August, 2007

Instrument Type and N0.: 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**		

C) i. Define **off-set** as used in **chain surveying.** **(2 marks)**

ii. What are the **three (3)** methods of **off-set measurement** identification and location used in **chain surveying?** **(3 marks)**

iii. Which of **these methods** is used for both **off-set** position **identification** and position **location?** **(1 mark)**

iv. An **off-set** was measured to be **30.0 m** and it was found to be **40.0 m** from the previous off-set along the chain line. If the measurements were **conducted accurately, calculate** the **length** of the **check.** **(4 marks)**

[30 marks]

QUESTION THREE

A) i. What are the other **two (2)** methods of **contouring** besides the grid method? **(2 marks)**

ii. **Discuss** in **detail** how you could conduct a **topographic survey** of a selected **agricultural land site** 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)**

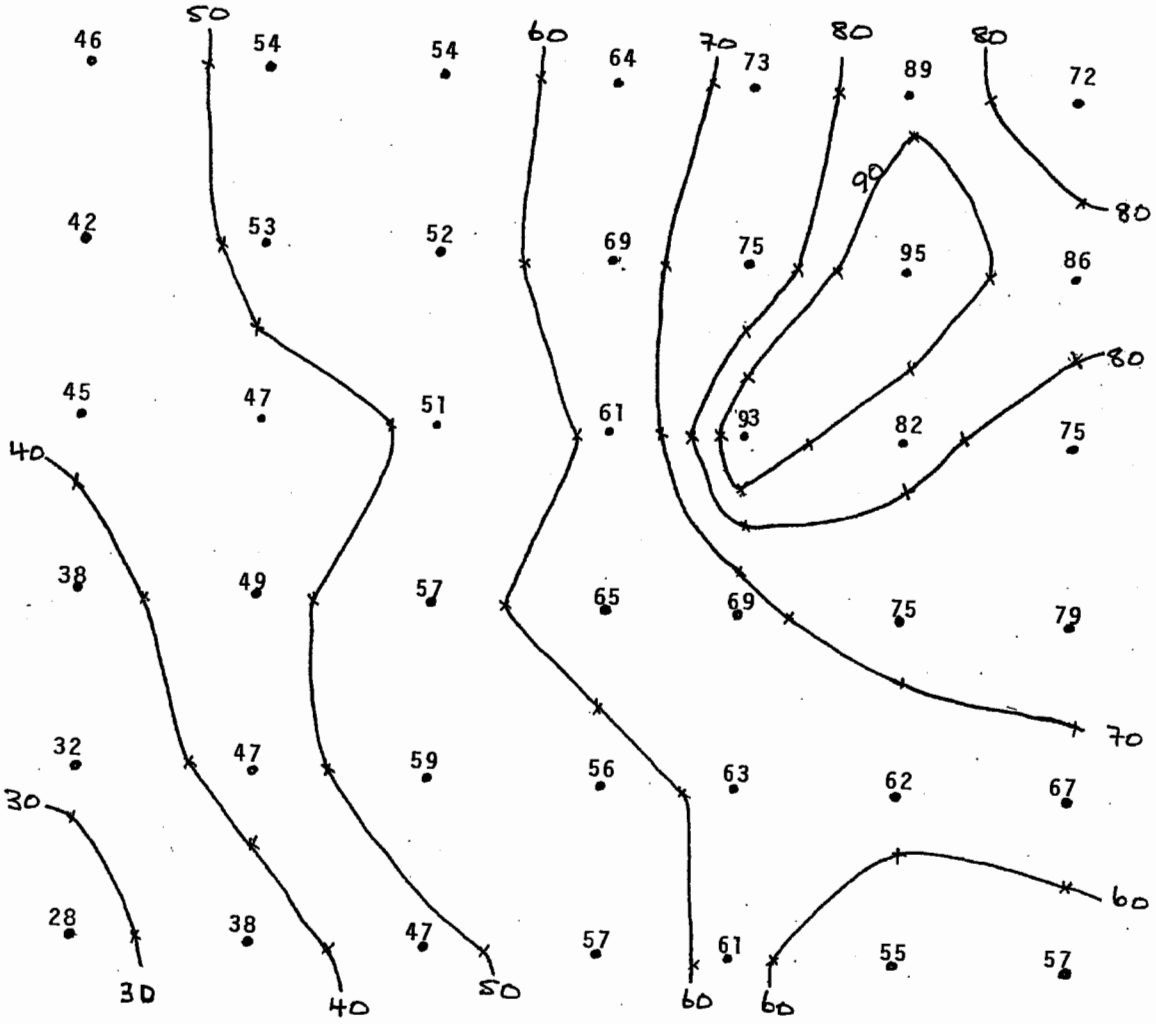
C) During the setting-out of a botanical garden, the site in question had to be leveled. To do this a topographic survey of **30 m x 30 m** was conducted in an attempt to provide the required contour map from which a formation depth of **1.5 m** was determined. The sum of **N** (the number of times the reduced level has been used) was computed as **40.0**, while the total height of the reduced level multiplied by N was **4840.0 m**. Compute the following:

i. Mean height. **(3 marks)**

ii. Depth of excavation. **(3 marks)**

iii. Volume of excavation. **(3 marks**

[30 marks]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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 near-by 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 10^0. **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]