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UNIVERSITY OF SWAZILAND
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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SECTION I: COMPULSARY

QUESTION ONE

A) Ms. Ndlela, a land surveyor had a task of levelling section **A-B** of Terrabethea farm in the Lowveld of Swaziland. She only knew the bench mark (**BM**), which was **41.030 m** above ordinance datum (**AOD**). Section **A-B** was **143.25 m** away from the **BM**, which meant that the surveyor had to take flying levels (**FL**) to reach the section in question as reflected in **Table 1**. The back site (**BS**) taken at the Bench Mark was **1.200 m** at FL_1. There was a change point at FL_1, where the Fore Sight (**FS**) was **1.410 m**. The **BS** taken at FL_2 was **1.790 m** and the **FS** was **0.810 m**, indicating a second change point. The **BS** taken at FL_3 was **0.610 m** and the subsequent measurements taken of section **A-B** were as shown in **Table 1**.

Table 1. Spot height levels of section **A-B** Terrabethea Farm, Lowveld, Swaziland.

Staff Station	A	A_1	A_2	A_3	A_4	A_5	A_6	B
Distance (m)	0	18.25	38.00	59.50	78.00	114.30	131.10	143.25
Spot Height (m)	0.555 **(IS)**	1.125 **(IS)**	2.200 **(IS)**	2.270 **(IS)**	3.150 **(IS)**	3.320 **(FS)**	0.980 **(BS)**	2.260 **(FS)**

i. Book the above data on **Table 2** using the rise and fall method. **(15 marks)**

ii. What is the other method of booking levelling data besides the **rise and fall** method? **(3 marks)**

B) **i.** What are the **three methods** that could be used for **slope measurement?** **(3 marks)**

ii. A land use planner was given a contour map or plan showing an area proposed for use as a botanical garden by the **Mankayane Town Board**. The map was drawn on a scale of **1:1000**. The land use planner was asked to determine the general slope of the area in order to facilitate decision making and planning. While doing this, she discovered that one of the major slope breaks occurred between contour lines **29.0 m** and **34.0 m**, whose distance was **10 cm** apart. Calculate the percentage slope for this slope break. **(5 marks)**

Examination N0.:.....

Table 2:.....

Surveyor: .....

Name and Location of Site: .....

Back Sight	Intermediate Sight	Fore Sight	Rise	Fall	Reduced Level	Distance (m)	Remarks

(15 marks)

C) A **land surveyor** performed the **operations** indicated on **Figure 1.**

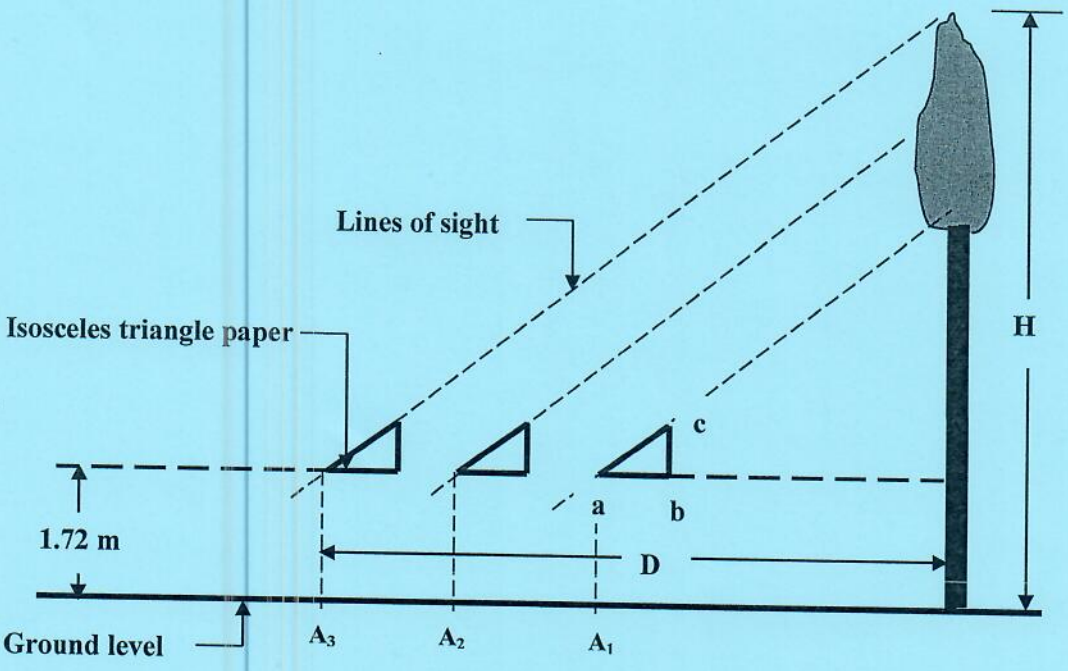

Figure 1. Land surveying field measurement.

i. What was the name of the land surveying **height measurement method** that was used by the land surveyor? **(2 marks)**

ii. Name the **other method** that could also be used for height measurement. **(2 marks)**

iii. If the distance **D** was **250.0 m**, calculate the height **(H)** of the object that was measured by the land surveyor. **Note** that A_1, A_2 and A_3 were survey stations. **(3 marks)**

D) 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. **(7 marks)**

[40 marks]

SECTION II: ANSWER ANY TWO QUESTIONS

QUESTION TWO

A) Linear measurements could be accomplished using various land surveying techniques. Name two of these techniques, one at each end of the land **surveying linear measurements techniques spectrum**. State the simplest and basic to the most complex and accurate.

(2 marks)

B) A small scale farmer had cash flow problems. He was advised to grow **green maize** (meallies) on **1.0 ha of the land** to increase his cash flow. However, he had to determine his field size and consequently the plant population. The farmer was advised to use an old bicycle wheel to measure his field size, but it had to be calibrated **(Table 3).**

Table 3. Bicycle wheel odometer calibration.

Measurement Run (x)	Length (Revolutions)
1	1.5
2	1.3
3	1.6

Upon calibration the field was measured and its dimensions were recorded in **Table 4.**

Table 4. Field measurement using a bicycle wheel odometer.

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

i. What was the **circumference** of the bicycle wheel after calibration if the **known distance** was **10.0 m?** **(3 marks)**

ii. Calculate the area of the **field** in m^2 and hectares **(ha).** **(4 marks)**

iii. What was the **land area** that was left after growing the green maize? **(2 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? **(5 marks)**

v. Why should the **bicycle wheel odometer** be **calibrated** prior to measurement? **(1 mark)**

C) i. What are the **four statements** that could be used to express map scales? **(4 marks)**

ii. What are the **three (3) categories** of **scale sizes?** **(3 marks)**

iii. A map had a scale of **1:40 000 000** and a principal scale of **1:20 000 000**, calculate the **scale factor** and explain what it **meant**. **(2 marks)**

iv. Explain briefly why **scales** are important in **land surveying**. **(4 marks)**

[30 marks]

QUESTION THREE

A) i. State how you would correct **systematic errors** for **lengths** and **areas** brought about by **damaged chains**. **(6 marks)**

ii. Given that the calculated area on a map of scale **1:1000** was **3000 cm^2** 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)**

B) i. **Name** any **three (3) methods** of computing areas from maps other than the Grid method. **(6 marks)**

ii. **Discuss in detail** how the **Grid** method could be used to determine the area of a given farm on a scaled map. **(10 marks)**

[30 marks]

QUESTION FOUR

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. What are the **four** (4) **surveyor's level telescope** stadia hairs? **(4 marks)**

ii. **Which of these stadia are used for distance measurement?** **(2 marks)**

iii. A **land 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. **(5 marks)**

[30 marks]