



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF THE BUILT ENVIRONMENT

DEPARTMENT OF QUANTITY SURVEYING

ENGINEERING SURVEYING

BQS 2110

**Supplementary Examination Paper
August 2024**

This examination paper consists of 8 printed pages

Examiner's name : Eng. Mudhindi
Time Allowed : 3 hours
Total Marks : 100

INSTRUCTIONS

Answer any five (5) questions

Special requirements : Graph Paper

MARK ALLOCATION

QUESTION	MARKS
1	20
2	20
3	20
4	20
5	20
6	20
TOTAL	100

Question One

The data from a survey are shown below in Table 1

Station	Point	BS	IS	FS	Rise	Fall	RL	CH
1	TBM	0.773					+ 54.300	
1,2	A1	0.802		1.554				0
2	B2		2.313					20
2,3	C3	3.583		1.992				40
3	D4		1.222					60
3	E5		3.677					80
3,4	F6	2.410		4.03				100
4	G7		0.343					120
4	H8			0.160				140

Table 1

- Use the Rise and Fall method to reduce data. [7 marks]
- Use arithmetic checks to support your answer. [2 marks]
- Plot the longitudinal profile using the height against the distance [5 marks]
- On the same graph you plotted at (b), plot the profile of a proposed road which will start at Chainage 0 meters with Reduced Level of 41.100m. The road will end at Chainage 100m and Reduced Level of 42.300m. Indicate which areas will need to be excavated and which areas will need to be filled

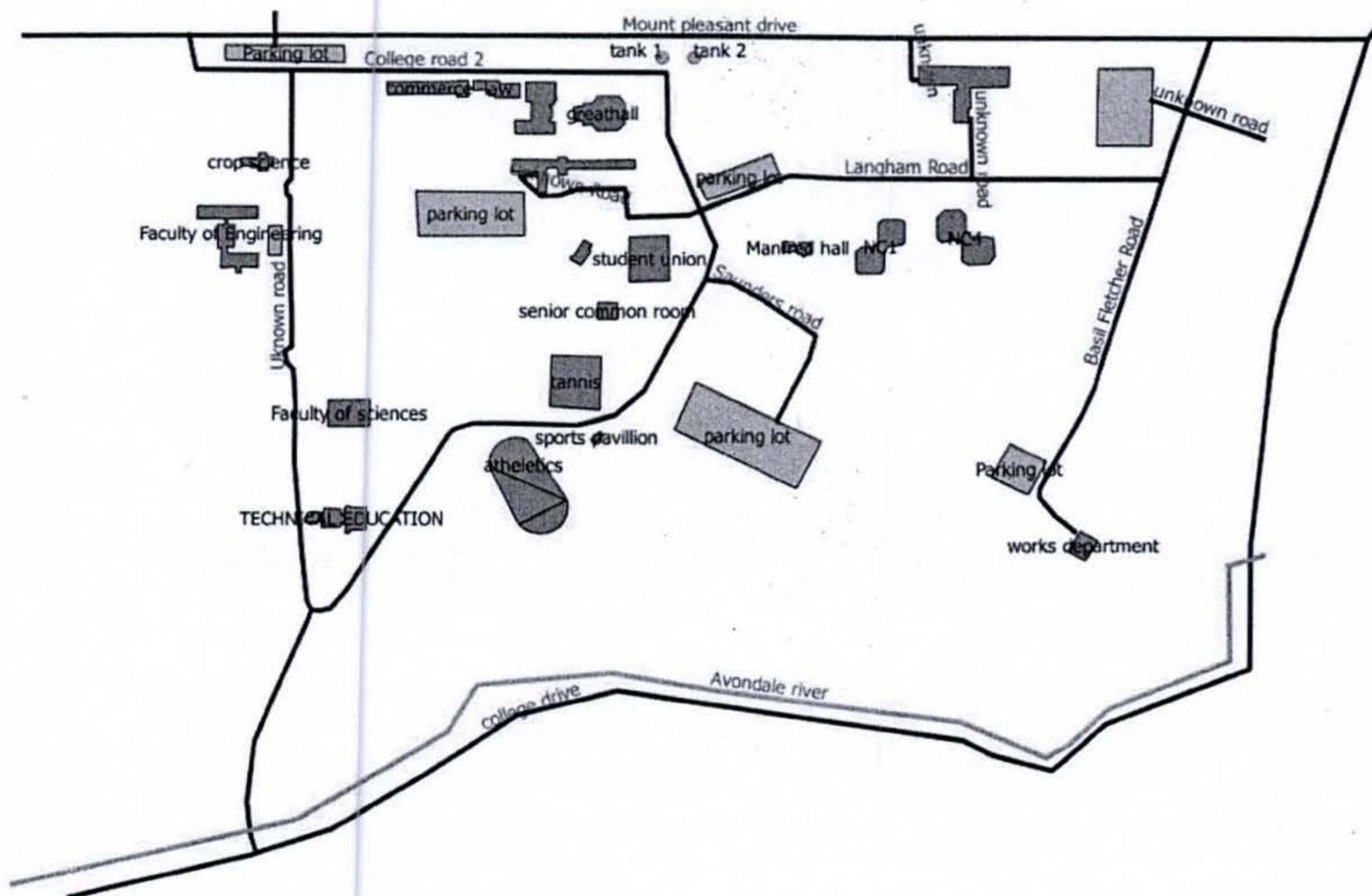
- e. Find the gradient of the above road. [2 marks]
- f. What would the RL of the road be at a chainage of 120m? [2 marks]
- g. We plan to build a different road which would start at a Chainage of 0 meters at an elevation of 42.000m. The road would have a slope of + 5°. What would the elevation of the road be at a chainage of 160m? [2 marks]

Question Two

- a) i) Describe what is meant by the term 'cut and fill' as used in earthworks. [2 marks]
 ii) Differentiate between a 'sidehill cut' and a 'through' cut. [3 marks]
- b) Describe the 3, 4, 5 methods in setting out [5 marks]
- c) List any five different types of control that should be carried out to prevent any errors during setting out building plan on ground [5 marks]
- d) An access road to a quarry is being cut in a plane surface in the direction of strike, the full dip of 1 in 13 being to the left of the direction of drive. The road is to be constructed throughout on a formation grade of 1 in 40 dipping, formation width 30 m and level, side slopes 1 in 2 and a zero depth on the centre-line at chainage 0 m. At chainage 400 m the direction of the road turns abruptly through a clockwise angle of 40°; calculate the volume of excavation between chainages 450 m and 650 m. [5 marks]

Question Three

- a) Define the following terms as used in GIS
- i. Spatial data
 - ii. Geographic phenomena
 - iii. Field
 - iv. Objects [4 marks]
- b) Describe the application of GIS in the field of Quantity Surveying [3 marks]
- c) Figure 1 shows a digitized map of a certain University in Zimbabwe



From the identify any two (2)

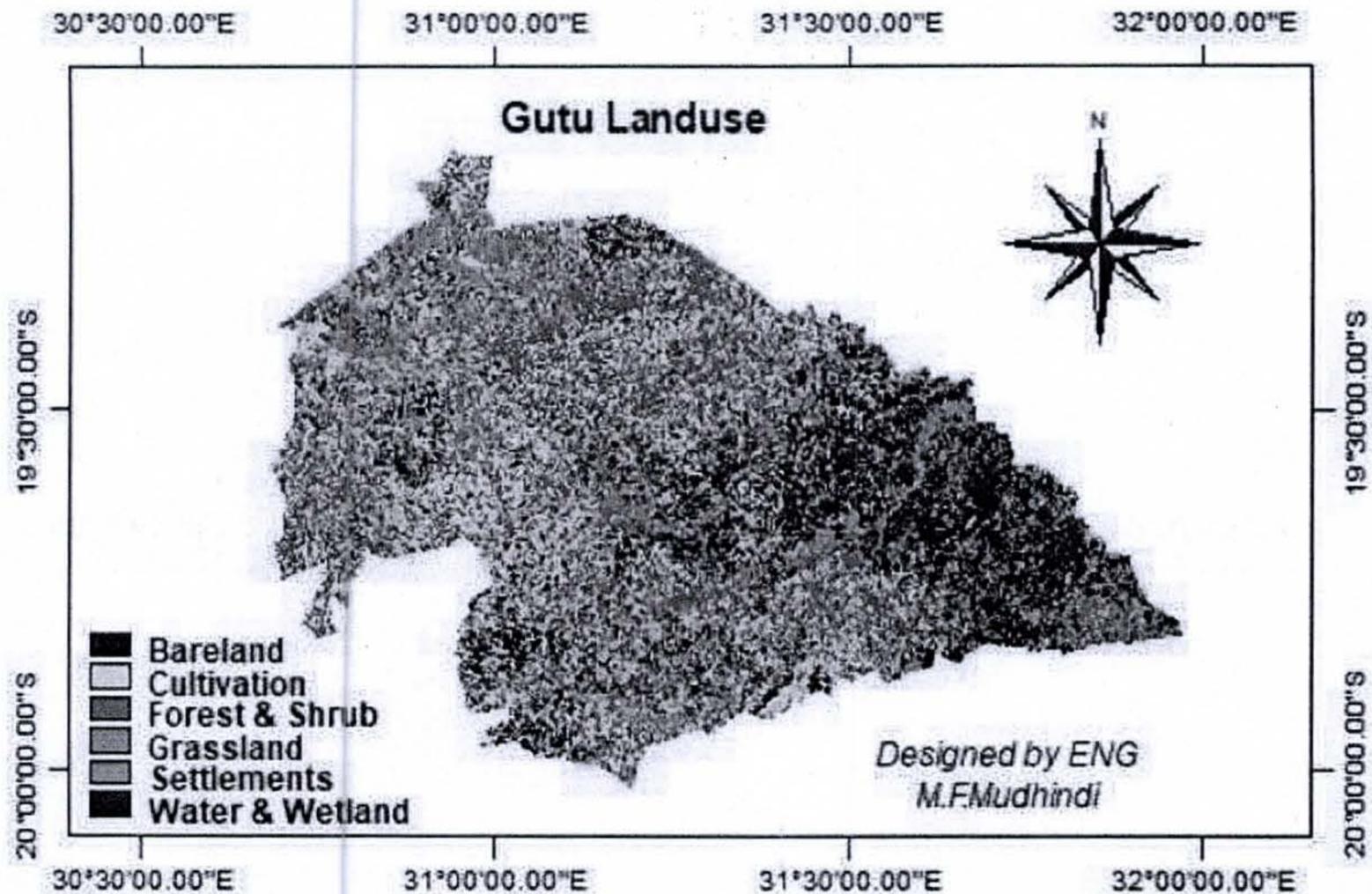
[3 marks]

- i. Lines
- ii. Polygons
- iii. Points

d) Describe digitization process in GIS

[5 marks]

e) Below is a map of Gutu land use (Figure 2)



Referring to figure 2, Illustrate the mapping process

[5 marks]

Question Four

a. Define chaining and state its fundamental principle

[2 marks]

b. Explain the operations that are involved in chaining

[3 marks]

c. A 30 m steel tape was standardized on flat ground at a temperature of 36°C under a pull of 15 kg. The tape was used in catenary at a temperature of 30°C under a pull of 10 kg. The cross sectional area of the tape is 20 mm^2 and its total weight is 600 g. The young's modulus and coefficient of thermal expansion for steel are 21000 kg/mm^2 and $11 \times 10^{-6}\text{ }^{\circ}\text{C}$ respectively. Find the correct length of the tape. [5 marks]

d. A tract of land has three straight boundaries AB, BC, and CD. The fourth boundary DA is irregular. The measured lengths are as under: AB = 135 m, BC = 191 m, CD = 126 m, BD = 255 m. The offsets measured outside the boundary DA to the irregular boundary at a regular interval of 40 m from D, are shown below in

Table 1:

Distance from D (m)	0.0	40	80	120	160	200	240
Offsets (m)	0.0	3.6	4.8	4.3	2.9	3.7	0.0

Table 1

Determine the area of the tract.

[10 marks]

Question Five

The following data in **Table 2** refer to a section of base line measured by a tape hung in catenary

Bay	Observed length (m)	Mean temperature (°C)	Reduced levels of index marks (m)
1	30.032	25.3	293.240 293.610
2	30.110	25.5	293.610 294.030
3	30.200	25.3	294.030 294.498
4	30.074	25.5	294.498 294.000
5	30.137	24.6	294.000 293.340

Table 2

Length of tape between 0 and 30 m graduations when horizontal at 23°C and under 10 kg tension is 29.9988 m; cross-sectional area of tape = 2.98 mm²; tension used in the field = 5 kg; temperature coefficient of expansion of tape = 11.16 × 10⁻⁶ per °C; elastic modulus for material of tape = 20.4 × 10⁴ N/mm²; weight of tape per metre length = 0.02 kg; mean radius of the earth = 6.4 × 10⁶ m. Calculate the corrected length of this section of the line.

[20 marks]

Question Six

a. The following staff readings were observed (in the order given) when levelling up a hillside from a **TBM** 155.3 m **AOD**. Excepting the staff position immediately after the **TBM**, each staff position was higher than the preceding one.

1.393

2.640

1.790

0.995

3.900

2.568

1.669

0.314

3.280

2.012

0.665

4.246

2.684

0.984

3.805

1.829

3.378

1.552

Enter the readings in level-book form by collimation systems

[10 marks]

b. The coordinates of traverse stations of a closed traverse ABCDE are given in **Table 3**

Station	X(m)	Y(m)
A	+0	0
B	+290	+350
C	+490	+110
D	+360	-130
E	-50	-230

Table 3

Calculate the area enclosed by the traverse.

[10 marks]

END OF EXAMINATION