

073106T4LAS

LAND SURVEY AND MAPPING LEVEL 6

LSM/OS/LS/CC/02/6

Operate Survey Instruments

November/December 2025



**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION
COUNCIL (TVET CDACC)**

WRITTEN ASSESSMENT

Time: 3 HOURS

INSTRUCTIONS TO CANDIDATE

1. Marks for each question are indicated in the brackets.
2. The paper consists of **TWO** sections: **A** and **B**.
3. Attempt **ALL** the questions in section A and any **THREE** questions in section B.
4. Candidates are provided with a separate answer booklet
5. **DO NOT** write on this question paper.

This paper consists of FIVE (5) printed pages. Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

SECTION A:(40 MARKS)

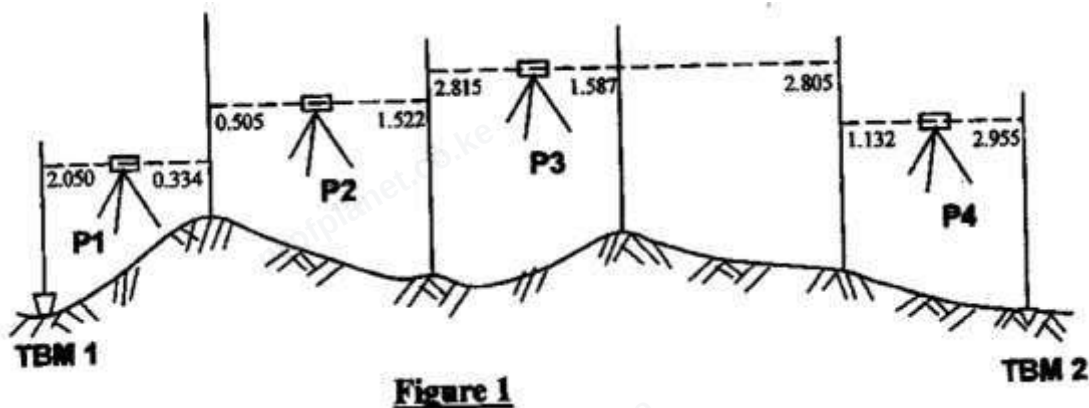
Answer ALL questions in this section.

1. The theodolite is one of the main instruments used for providing accurate readings of both horizontal and vertical angles. Highlight the procedure for using a theodolite to measure a horizontal angle. (4 Marks)
2. Accurate distance measurement is critical for producing reliable maps and boundary surveys. Outline FOUR corrections applied in steel taping and their purpose. (4 Marks)
3. In surveying, the determination of distances is essential for mapping, engineering design, and construction works. Explain the working principle of Electronic Distance Measurement (EDM). (4 Marks)
4. A Total Station is an advanced surveying instrument that helps obtain accurate results using a systematic procedure. Highlight FIVE steps in operating a Total Station in the field. (5 Marks)
5. In surveying, distance measurement is one of the most fundamental tasks. Compare traditional taping with EDM in terms of accuracy and efficiency. (4 Marks)
6. Angular measurement is prone to errors that may reduce accuracy if not identified and minimized. Highlight THREE sources of error in angular measurements. (3 Marks)
7. To maintain the accuracy of a theodolite, certain permanent adjustments are required. Outline FOUR permanent adjustments needed for accurate theodolite readings. (4 Marks)
8. Angles can be expressed in different units such as degrees, minutes, seconds, or radians. A surveyor observes the horizontal angle from point X to Y as $65^{\circ}42'15''$. Convert to radians. (3 Marks)
9. The accuracy of linear measuring instruments depends not only on correct usage but also on proper maintenance. Explain FOUR common maintenance practices. (4 Marks)
10. Different methods of levelling are applied depending on the accuracy required, the nature of the terrain, and the available instruments. Briefly explain any FIVE levelling methods. (5 Marks)

SECTION B:(60 MARKS) *Answer any THREE Questions in This Section.*

11.

- a. The choice of a linear measuring instrument in surveying is influenced by various considerations. Highlight THREE factors to be considered when selecting a linear measuring instrument. (3 Marks)
- b. Static GNSS and Real-Time Kinematic (RTK) are two commonly used methods for positioning and mapping. Differentiate between static GNSS surveying and real-time kinematic (RTK) methods. (4 Marks)
- c. The following levelling data in **Figure 1** was obtained to measure the heights of different points in a levelling exercise from TBM 1 and TBM 2.



Given that the reduced level of TBM 2 is 6m above sea level; Book the readings in a standard format and reduce them by Rise and Fall method and apply necessary arithmetic checks. (13 Marks)

12. The following field note abstracts are for a traverse run between two control points Q and XY. Datum coordinates and bearings are given in **Table 1**. Use the information to prepare a traverse bearing sheet. (20 Marks)

At Q

P $194^{\circ} 57' 24''$
 R $104^{\circ} 57' 24''$
 TR1 $014^{\circ} 56' 50''$

AT TR2

TR1 $219^{\circ} 28' 20''$
 TR3 $039^{\circ} 30' 57''$

AT TR1

Q 194° 56' 42"

TR2 039° 28' 15"

AT TR3

TR2 219° 30' 50"

TR4 043° 36' 48"

AT TR4

TR3 223° 36' 40"

XY 056° 15' 58"

AT XY

TR4 236° 15' 52"

PT11 297° 33' 20"

PT8 116° 17' 40"

Table 1

Station	Datum Coordinates	
	Northings(m)	Eastings(m)
P	-140736.90	-18906.81
Q	-140276.97	-18783.92
Bearings	XY-PT11	297° 34' 11"
	XY-PT8	116° 18' 33"

13.

- a. In modern surveying, Global Navigation Satellite Systems (GNSS) have revolutionized data collection.

i. Describe the principle of GNSS technology. (3 Marks)

ii. State THREE advantages of GNSS over traditional land surveying methods.

(3 Marks)

- b Theodolites and Total stations are both designed for angular measurements, their level of precision differ significantly. Compare theodolites and total stations in terms of angular measurement capabilities, precision, and field usage. (6 Marks)

c. Before using a theodolite for field observations, certain temporary adjustments must be carried out. Briefly describe the temporary adjustments of a theodolite.

(8 Marks)

14.

- a. Differential levelling procedure ensures accurate transfer of elevations over short or long distances. Describe the procedure for conducting differential levelling using a dumpy level and how to close a levelling loop. (10 Marks)

- b. Total station allows simultaneous measurement of angles and distances, making it a versatile tool.
- i. Explain how Total Station integrates both angular and linear measurements. (6 Marks)
 - ii. Explain FOUR advantages over traditional equipment. (4 Marks)