



**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

**UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR**

SECOND YEAR SECOND SEMESTER EXAMINATIONS

**FOR THE DEGREE
OF
BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL
ENGINEERING**

COURSE CODE: CSE 244

COURSE TITLE: ENGINEERING SURVEYING II

DATE: WEDNESDAY 27TH APRIL 2022 TIME: 8.00 – 10.00 AM

INSTRUCTIONS:

1. This paper contains **FOUR** questions
2. Answer any **THREE** questions
3. Marks for each question are indicated in the parenthesis.
4. Examination duration is **2 Hours**

MMUST observes **ZERO** tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.

QUESTION 1 (25 Marks)

- (a) Define a Total station and concisely explain why you need to carry out an electronic calibration on a Total station (8 Marks)
- (b) The standard errors of a single measurement of length by an EDM instrument was given as $\pm 1.5\text{mm}$ and $\pm 3\text{mm/km}$. What are the errors 1.5mm and 3mm called? What is the overall standard error of a measurement of 1500m made by the same EDM? (4 Marks)
- (c) Outline FOUR uses of angular measurements in engineering surveying (4 marks)
- (d) In a tacheometric traverse, of which the first three stations are *A*, *B* and *C*, at station *B* it is found that the instrument height had not been measured above the peg *A*. Find from the tabulated readings the missing instrument height and the reduced level of the ground at *C*, if that at *A* is 83.44m. The instrument constants are 100 and 0.

Station	point	Verticle circle reading	stadia readings	Height of instrument (m)
<i>A</i>	<i>B</i>	$+5^{\circ} 42'$	2.43, 2.07, 1.71	?
<i>B</i>	<i>A</i>	$-5^{\circ} 24'$	1.68, 1.34, 1.00	1.28
<i>B</i>	<i>C</i>	$-5^{\circ} 24'$	1.68, 1.44, 1.20	1.28

(9 Marks)

QUESTION 2 (25 Marks)

- (a) Define what you understand by a theodolite? (2 Marks)
- (b) Using neat sketches differentiate between the following terms as used in traverse work
 (i) "direction", "bearing", and "angle"
 (ii) "open traverse", "closed traverse" and "loop traverse" (11 Marks)
- (c) It is required to provide horizontal control in the area covered by points *t1*, *t2* ... *t6* as shown in Figure 2 below. The extract of the reduced data from the field notebook is as follows:

Bearings:

$$\begin{aligned}
 A - P &= 50^{\circ} 10' 15'' \\
 t1 - t2 &= 84^{\circ} 59' 58'' \\
 t3 - t2 &= 00^{\circ} 00' 16'' \\
 t4 - t5 &= 205^{\circ} 00' 11'' \\
 t6 - t5 &= 80^{\circ} 00' 15'' \\
 B - Q &= 125^{\circ} 36' 30''
 \end{aligned}$$

$$\begin{aligned}
 A - t1 &= 135^{\circ} 00' 07'' \\
 t2 - t1 &= 265^{\circ} 00' 00'' \\
 t3 - t4 &= 86^{\circ} 59' 59'' \\
 t5 - t4 &= 25^{\circ} 00' 03'' \\
 t6 - B &= 182^{\circ} 00' 24''
 \end{aligned}$$

$$\begin{aligned}
 t1 - A &= 314^{\circ} 59' 52'' \\
 t2 - t3 &= 180^{\circ} 00' 13'' \\
 t4 - t3 &= 266^{\circ} 59' 53'' \\
 t5 - t6 &= 259^{\circ} 59' 59'' \\
 B - t6 &= 02^{\circ} 00' 24''
 \end{aligned}$$

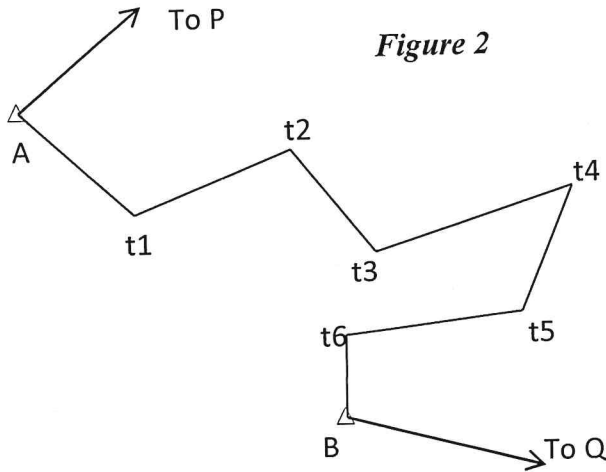


Figure 2

Distances

$A - t1 =$	69.97 m
$t1 - t2 =$	75.52 m
$t2 - t3 =$	80.11 m
$t3 - t4 =$	100.18 m
$t3 - t5 =$	95.59 m
$t5 - t6 =$	65.74 m
$t6 - B =$	90.80 m

The datum points have the following coordinates:

	N	(m)	E
A	1000.00		200.00
B	693.50		316.50
P	1160.10		392.00
Q	518.80		560.40

Compute and adjust the bearing sheet for the link traverse above.

(12 marks)

QUESTION 3 (25 Marks)

a) Outline the main considerations in choosing traverse stations (5 Marks)

b) The coordinates of two terminals of a traverse are known to be as follows:

	N	(m)	E
Dog	-460225.27		-61627.03
Pup	-458380.80		-60122.59

A traverse was run between them to obtain four new control points T1 through to T5. The adjusted observations are given below

Leg	Bearing	Distance (m)
Dog - T1:	14° 57' 00"	425.00
T1 - T2:	39 28 05	716.28
T2 - T3:	39 31 05	432.41
T3 - T4:	43 37 15	393.10
T4 - Pup:	56 15 55	473.07

Compute the traverse to determine the coordinates of the new points, also showing the accuracy of the traverse. (14 Marks)

- (c) Describe THREE methods of optical distance measurement (tacheometry) and state the sources of errors associated with tacheometry (6 Marks)

QUESTION 4 (25 Marks)

- (a) In connection with setting out levels, differentiate between a “sight rail” and a “traveller” (4 marks)
- (b) Discuss the use of Mass-Haul Diagrams in engineering projects (6 marks)
- (c) An existing sewer at *A* is to be continued to *B* and *C* on a falling gradient of 1 in 150 for plan distances 27.12 m and 54.11 m consecutively, where the positions of *A*, *B* and *C* are defined by wooden uprights.

Given the following level observations, calculate the difference in level between the top of each upright and the position at which the top edge of each sight rail must be set at *A*, *B* and *C* if a 2.5 m traveller is to be used.

Level reading to staff on BM (RL 89.52 m a.s.l)	0.39 m
Level reading to staff on top of upright at <i>A</i>	0.16 m
Level reading to staff on top of upright at <i>B</i>	0.35 m
Level reading to staff on top of upright at <i>C</i>	1.17 m
Level reading to staff on invert of existing sewer at <i>A</i>	2.84 m

All measurements were taken from the same instrument position.

(15 marks)