INTERNATIONAL UNIVERSITY OF EAST AFRICA
'Learning to Succeed'

FACULTY OF ENGINEERING

END OF SEMESTER EXAMINATIONS -APRIL 2025

Programme: Bachelor of Science in Civil Engineering

Year One/ Semester Two

Course code: BCE1204

Name: Civil Engineering Surveying I

DATE: 15/04/25 **TIME: 2:00-5:00pm**

INSTRUCTIONS TO CANDIDATES:

- ***ATTEMPT QUESTION ONE AND CHOOSE OTHER 3 QUESTIONS FOR FULL MARKS***
- ***Do not open this examination until you are told to do so***
- ***All rough work should be in your answer booklet***
- ***The time allowed for this examination is strictly three hours***

- ***On the first page of your answer booklet***
  - ***Write your registration number properly***
  - ***Write the course name and course code***
  - ***Write examination venue***
  - ***Do not write, draw or scratch anything else on the first page***
  - ***Writing unnecessary information like phone numbers in the first page shall annul your exam***
  - ***Answer booklets that do not carry the required information, or that have unnecessary writing in the first page shall not be marked***
  - ***Where appropriate, assume that Young's modulus (E) for steel is 200 kN/mm^2 and the coefficient of thermal expansion of steel (α) is 0.0000112 per °C.***

INTERNATIONAL UNIVERSITY OF EAST AFRICA
'Learning to Succeed'

FACULTY OF ENGINEERING

END OF SEMESTER EXAMINATIONS -APRIL 2025

QUESTION ONE (25 marks) (Compulsory)

a. Explain why it is not advisable to have a change point at an inverted staff position? **(3marks)**

b. Why is it necessary to try and keep sight lengths as equal as possible when levelling? **(3marks)**

c. What are the advantages of using a digital level compared to an automatic level? **(4 marks)**

d. Describe a test that can be carried out to determine the collimation error of a level. **(10marks)**

QUESTION TWO

a. What are the sources of error that occur most in taping and how can they be avoided? **(10 marks)**

b. Explain how parallax occurs and describe a procedure for removing it from a level. **(10 marks)**

QUESTION THREE (25marks)

a. With an illustration, differentiate between Zenith angle, vertical angle and horizontal angle. **(9 marks)**

b. Make a copy of the theodolite booking form, enter the readings below and calculate values for the horizontal and vertical angles observed**. (11marks)**

Point sighted and face	Horizontal circle reading	Vertical circle reading
W FL	02°17'16"	87°06'26"
X FL	137°52'20"	93°16'31"
Y FL	209°22'37"	91°17'49"
Z FL	312°14'50"	88°32'44"
Z FR	132°15'01"	271°26'51"
Y FR	29°22'48"	268°41'41"
X FR	317°52'33"	266°43'09"
W FR	182°17'29"	272°53'14"

INTERNATIONAL UNIVERSITY OF EAST AFRICA
'Learning to Succeed'

FACULTY OF ENGINEERING

END OF SEMESTER EXAMINATIONS -APRIL 2025

QUESTION FOUR (25 marks)

a. Explain the procedure of a distance of 100m using a 30m tape (**10 marks)**

b. The distance between two points A and B is recorded as 27.554 m but without applying any corrections to the measurement. Later, this was checked and found to be 27.567 m but at a recorded tension of 50 N and temperature of 20 °C. The difference in level between A and B was known to be 0.15 m. If the 30 m tape used had been standardised as having a length of 30.007 m at a tension of 50 N and temperature of 10 °C and has dimensions of 13 × 0. 2 mm, determine by how much the original measurement was in error. **(10 marks)**

QUESTION FIVE (25 marks)

a. List, with their formulae, the five corrections that apply to taping. **(5 marks)**

b. Explain 3 methods used in measuring slope distance using a tape measure. **(6marks)**

c. Discuss the circumstances under which you might choose to use a fibreglass tape instead of a steel tape for distance measurements on a construction site. **(4marks)**

d. A steel tape of nominal length 30 m was used to transfer a level from point C1 near the base of a reinforced concrete column to another point C2 near its top.

Just before the measurement was done, the tape was standardised against a 30 m reference tape as 30.015 m at a tension of 50 N. From data published by the manufacturer, the cross-sectional area of the tape was found to be 1. 7 mm^2.

On site, a 100 N weight was attached to the tape and it was hung down the side of the column in a vertical position with its 1 m mark held against C1. A reading of 20.839 m was obtained at C2.

If the reduced level of C1 at the bottom of the column is 12.365 m, calculate the reduced level of C2 at the top. **(10 marks)**

QUESTION SIX (20marks)

a. Differentiate between the following **(4 marks)**

INTERNATIONAL UNIVERSITY OF EAST AFRICA
'Learning to Succeed'

FACULTY OF ENGINEERING

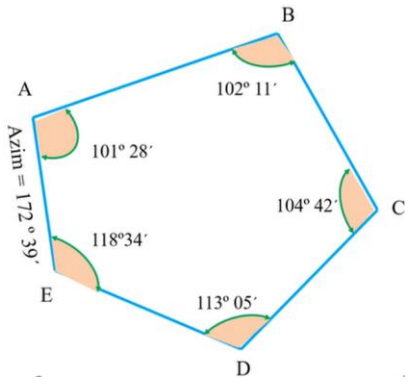
END OF SEMESTER EXAMINATIONS -APRIL 2025

i. Azimuth and bearing

ii. Horizontal and vertical Angels

b. Define Traverse and describe its application in surveying exercise. **(6 marks)**

c. The azimuth of side *A-E* is given for the five-sided traverse shown in the following figure Q6. The five interior angles are also given. Determine the *azimuth direction* for the other sides. **(10 marks**)



QUESTION SEVEN

a. Some zenith angles are measured with a theodolite and the readings below were taken:

Point	Face left reading	Face right reading
D1	87°23'38"	272°38'26"
D2	91°48'09"	268°13'49"
D3	95°19'52"	264°42'10"
D4	89°48'17"	270°13'40"

Using these readings, calculate the vertical angles corresponding to each zenith angle and the value of the vertical collimation error. **(10 marks)**

b. A page of level book is reproduced below in which some readings marked as (X), are missing. Complete the page with all arithmetic checks. **(10 marks)**

INTERNATIONAL UNIVERSITY OF EAST AFRICA
'Learning to Succeed'

FACULTY OF ENGINEERING

END OF SEMESTER EXAMINATIONS -APRIL 2025

Station	B.S.	I.S.	F.S.	Rise	Fall	R.L.	Remarks
1	3.150					×	
2	1.770		×		0.700	×	C.P.
3		2.200			×	×	
4	×		1.850	×		×	C.P.
5		2.440			0.010	×	
6	×		×	1.100		×	C.P.
7	1.185		2.010	×		222.200	C.P.
8		–2.735		×		×	Staff held inverted
9	×		1.685		4.420	×	C.P.
10			1.525		0.805	×	
Σ	12.055		×	×	×		

QUESTION EIGHT

a. Discuss the circumstances under which you might choose to use a fibreglass tape instead of a steel tape for distance measurements on a construction site. **(4 marks)**

b. A steel tape has the following properties: Nominal length: 50 m Standardised length: 50.010 m at 50 N tension and 20 °C Cross-sectional area: 2.5 mm^2 Weight: 0.15 Nm^{-1}. For a recorded length of 40.000 m with this tape,
calculate the following corrections:
Slope, where the height differences between the ends of the line are 1m and 2m. **(6 marks)**

i. Standardisation **(4 marks)**

ii. Tension if 35 N and 75 N are applied to the tape for the measurement Temperature if this is 10 °C and 25 °C during the measurement Sag with tensions of 50 and 100 N applied to the tape (assume the slope angle is zero). **(6marks)**

QUESTION NINE **(20 marks)**

a. The distance between two points A and B is recorded as 27.554 m but without applying any corrections to the measurement. Later, this was checked and found to be 27.567 m but at a recorded tension of 50 N and temperature of 20 °C. The difference in level between A and B was known to be 0.15 m. If the 30 m tape used had been standardised as having a length of 30.007 m at a tension of 50 N and temperature of 10 °C and has

dimensions of 13 × 0. 2 mm, determine by how much the original measurement was in error. **(15 marks)**

b. A digital level was checked for collimation error using a two-peg test and the following results were obtained. With the level midway between two pegs B1 and B2 which are 40 m apart: Staff reading at B1 = 1.476 m
Staff reading at B2 = 1.432 m
Level set up 10 m from B2 along the line B1–B2 extended:
Staff reading at B1 = 1.556 m
Staff reading at B2 = 1.472 m
Calculate the collimation error in the level and the readings that would have been obtained with the level in the second position close to B2 had it been in perfect adjustment. **(5 marks)**

QUESTION TEN (20 marks)

a. Explain why it is not advisable to have a change point at an inverted staff position. **(2marks)**

b. State 3 sources of error that can occur in levelling and describe how these can be minimised. **(6 marks)**

c. For the levelling shown below, calculate adjusted reduced levels for all points in the level table. **(12 marks)**

INTERNATIONAL UNIVERSITY OF EAST AFRICA
'Learning to Succeed'

FACULTY OF ENGINEERING

END OF SEMESTER EXAMINATIONS -APRIL 2025

BS	IS	FS	Remarks
1.832			TBM 62.117 m
2.150		2.379	Change point
	1.912		A
	1.949		B
	2.630		C
1.165		1.539	D
2.381		2.212	Change point
	2.070		E
	2.930		F
	0.954		G
	2.425		H
		0.879	TBM 62.629 m

END

GOOD LUCK