1308/314
LAND SURVEYING THEORY
Oct./Nov. 2021
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN LAND SURVEYING

LAND SURVEYING THEORY

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
  Answer booklet;
  Scientific calculator;
  Survey computation forms (C/22).
*This paper consists of **EIGHT** questions.*
*Answer **FIVE** questions.*
All questions carry equal marks.
Maximum marks for each part of a question are as indicated.
Candidates should answer the questions in English.

This paper consists of 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.

Turn over

1. (a) Define each of the following terms as used in contouring

    (i) contour line;

    (ii) contour interval;

    (iii) horizontal equivalent;

    (iv) gradient.

(6 marks)

(b) The following is an extract from a levelling notebook done using the rise and fall method. Fill in the missing entries and apply the usual arithmetic checks.

BS	IS	FS	Rise	Fall	Reduced levels (m)	Remarks
____					32.517	BM1
	2.985		0.405		____	
	____		0.669		____	
1.988		____		0.296	____	
	____			____	32.868	
____		1.316	1.099		____	
		1.532	1.888		35.855	BM2

(14 marks)

2. (a) Using the following information, calculate the reduced horizontal distance of line PQ measured with a chain in catenary.

Measured slope distance PQ	=	52.195 m
Vertical circle reading	=	88° 35′
Tension applied	=	9 kgf
Field temperature	=	27° C
Standard tension	=	9 kgf
Standard temperature of chain	=	22°C
Co-efficient of linear expansivity of material	=	$1.17 \times 10^{-5}/°C$
Altitude of the place	=	1600 m above mean sea level
Radius of the earth	=	6378 km
Weight of chain per 30 m	=	0.198 kg

(8 marks)

(b)   **Figure 1** shows a section of a road embankment. Using the information on the figure calculate the volume of the earth in the section by prismoidal formula.   (12 marks)
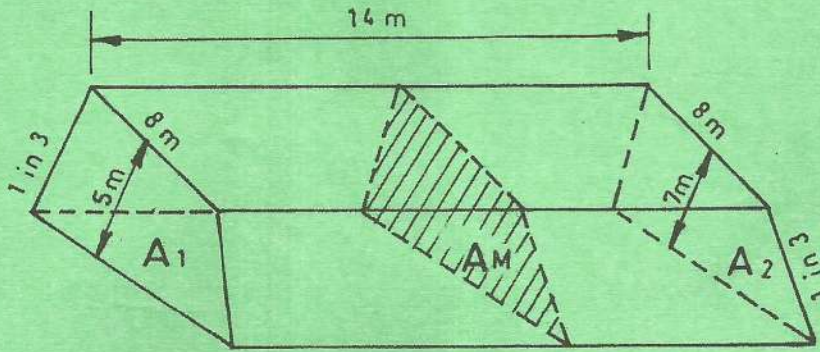

Fig.1

3.   **Table 1** shows adjusted bearings and corrected distances of a traverse run from R1 to R2. Using the data in **table 1** and datum coordinates in **table 2** compute and adjust the traverse by Bowditch's method.   (20 marks)

Table 1

Line	Bearing			Distance (m)
T1 - K1	60°	58′	00″	62.21
K1 - K2	147°	56′	12″	130.57
K2 - K3	156°	47′	32″	63.99
K3 - K4	159°	41′	17″	134.28
K4 - K5	187°	13′	14″	109.35
K5 - R2	151°	00′	45″	120.37

Table 2

Point	Northing (+)	Easting (+)
R2	1540.840	3837.140
R1	2019.680	3596.790

4.   **Table 3b** shows traverse angular observations abstracts. Using the datum bearings in **table 3a**, compute adjusted bearings for the traverse.   (20 marks)

Table 3a

Line	Datum Bearing		
P1 - P2	194°	59′	06″
P3 - P1	285°	02′	12″
P4 - P5	297°	35′	35″
P6 - P4	296°	19′	53″

Table 3b

Station	Observed bearing		
@P1			
P2	194°	58′	59″
P3	105°	02′	08″
r1	14°	58′	54″
@r1			
P1	194°	58′	11″
r2	39°	30′	13″
@r2			
r1	219°	29′	54″
r2	39°	32′	51″
@r3			
r2	219°	32′	52″
r4	56°	17′	55″
@P4			
r3	236°	17′	59″
P5	297°	35′	33″
P6	116°	19′	48″

5. A circular curve of radius 600 m is to connect two straights ABI and CDI at A and C respectively. The intersection point I is inaccessible and therefore the deflection angle is indeterminable. If the angles at B and D and the distance BD are measured as follows:

ABD: 165° 50'
BDC: 146° 12'
BD: 330 M

Calculate the:

(a)   distance of the tangent points from B and D on the respective straights.

(b)   length of last subchord, if the curve is set out at 30 m intervals and the chainage at B is 2030.50 m.

(20 marks)

6.   (a)   State **five** disadvantages of plane table surveying.   (5 marks)

(b)   Outline the traversing method of plane table surveying.   (15 marks)

7. **Table 4** shows observations made using a tacheometer fitted with an anallactic leans. Use the information to calculate:

    (a)   the distance BC.

    (b)   the reduced levels of A and B if the reduced level of C is 250 m.

                                                    (20 marks)

Table 4

Instrument station	Staff station	Bearing			Vertical angle		Stadia readings	
							Top	Mid
A	B	55°	30′	00″	+5°	30′	2.855	2.255
	C	100°	30	00″	−2°	30′	3.250	2.500

8.   (a)   Describe the procedure of setting up a theodolite in readiness for taking observations.

                                                            (11 marks)

    (b)   With the aid of a diagram, show that the formula for determining the curvature of the earth in levelling is given by:

$$x = \frac{d^2}{2R}$$

where, d is the horizontal distance between the staff station and instrument station.
                 R is the radius of the earth.

                                                          (9 marks)

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