Name:_____ Scu lupy _____ Index No._____

2306/302
SURVEYING
Oct./Nov. 2015
Time: 3 hours

Candidate's Signature:_____

Date:_____

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN QUANTITY SURVEYING

SURVEYING

3 hours

INSTRUCTIONS TO CANDIDATES

Write your name and index number in the spaces provided above.
Sign and write the date of the examination in the spaces provided above.
You should have a scientific calculator for this examination.
*Answer **FIVE** of the **EIGHT** questions in the spaces provided in this question paper.*
All questions carry equal marks.
Maximum marks for each part of a question are as shown.
Candidates should answer the questions in English.

For Examiner's Use Only

Question	1	2	3	4	5	6	7	8	TOTAL SCORE
Candidate's Score									

This paper consists of 16 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) List **six** types of surveys that are encountered in land surveying. (3 marks)

   (b) Define the following terms as used in chain surveying:

   (i) base line;
   (ii) survey station;
   (iii) check line;
   (iv) offset.

   (4 marks)

   (c) State the stages that are involved when carrying out a chain surveying task.
   (5 marks)

   (d) With the aid of a diagram, explain how to find a point on the chain line which produces a perpendicular from a point outside the chain line, when the point is not accessible.
   (5 marks)

   (e) A survey line was measured on a sloping ground and recorded as 117.84 m. The difference in elevation between the end points was 5.88 m. The tape used was later found to be 20.63 m when compared with a standard 20 m tape. Calculate the horizontal length of the line. (3 marks)

2. (a) Define the following terms as used in levelling:

   (i) level line;
   (ii) horizontal line;
   (iii) levelling;
   (iv) back sight;
   (v) bench mark.

   (5 marks)

   (b) With the aid of sketches explain the field procedure of carrying out temporary adjustment of a tilting level having a split bubble viewing system. (10 marks)

   (c) A levelling instrument was set at point T on line XY, 30 m from X and 800 m from Y. The backsight reading on X was 2.654 m and the foresight on Y was 2.786 m. Taking the combined correction for curvature and retraction as c & r = 0.0673 D^2, determine the difference in height between X and Y. D is the distance between the instrument and the staff in kilometers. (5 marks)

3. (a) (i) Explain why reciprocal levelling is carried out stating **two** areas where it is applied.

   (ii) State **two** errors that reciprocal levelling can eliminate.

   (5 marks)

(b) **Table 1** shows level readings with some entries missing:

(i) determine the missing entries X_1 to X_6.

(ii) tabulate the results without deducing the values of falls and rises.

(15 marks)

Table 1

BS	IS	FS	RISE	FALL	R.L	Remarks
2.816	X_1				133.500	1
	X_2				134.105	2
X_3		X_4			134.372	3
	1.917				135.024	4
	2.312				135.668	5
		2.184			X_5	6
					X_6	7

4. (a) State the relationships that should hold true for a theodolite to be in perfect adjustment.

(6 marks)

(b) (i) State the purpose of adjusting a vertical angle index of a theodolite.

(ii) Outline the field procedure of testing and adjusting the vertical angle index of a theodolite.

(8 marks)

(c) (i) Define the term "setting out" as used in levelling.

(ii) Outline the field procedure of setting out a building to ground-floor level.

(6 marks)

5. (a) State **four** sources of error in tacheometric levelling. (4 marks)

(b) **Table 2** shows observations taken with a tacheometer having constants 100 and zero from point P to points S and T. The horizontal distance ST was measured as 160.00 m. Assuming the ground to be plane in triangle PTS, the reduced level of point P to be 1000.00 m above datum and the height of instrument at P to be 1.50 m, calculate:

(i) the horizontal and vertical distances PT and PS;
(ii) the reduced levels of points T and S, deducing the difference in level between them.
(iii) the area of triangle PTS in hectares and the horizontal angle at P.

(16 marks)

Table 2

At	To	Staff Readings			Vertical angle
		Lower	Mid	Top	
P	S	0.480	1.730	2.980	+ 06° 36'
	T	1.080	1.820	2.560	- 04° 24'

6. (a) Convert the following whole circle bearing to qudrantal bearing:

(i) 065° 30';
(ii) 160 20;
(iii) 255 10;
(iv) 336 40.

(6 marks)

(b) **Table 3** shows reduced distance and final bearings of a traverse run between two control points P and R. Using this information and the coordinates in **table 4**, compute the adjusted coordinates of the new traverse points by the Bowditch's method of adjustment. (14 marks)

Table 3

Line	Bearing	Distance (m)
p - Tr$_1$	115° 22' 22"	198.47
Tr$_1$ - Tr$_2$	084 30 28	265.46
Tr$_2$ - Tr$_3$	128 37 56	159.13
Tr$_3$ - Tr$_4$	105 59 45	337.52
Tr$_4$ - R	093 04 56	242.20

Table 4

STN	COORDINATES	
	Northings (m)	Eastings
P	+ 2956.88	+ 1174.78
R	+ 2591.78	+ 2309.03

7.   (a)   List:

(i)   **four** elements of a simple circular curve.

(ii)   **two** ways of designating simple circular curves.

(iii)   **four** methods of setting out simple circular curves.

(6 marks)

(b)   **Figure 1** shows two straights intersecting at point I, having the following bearings:
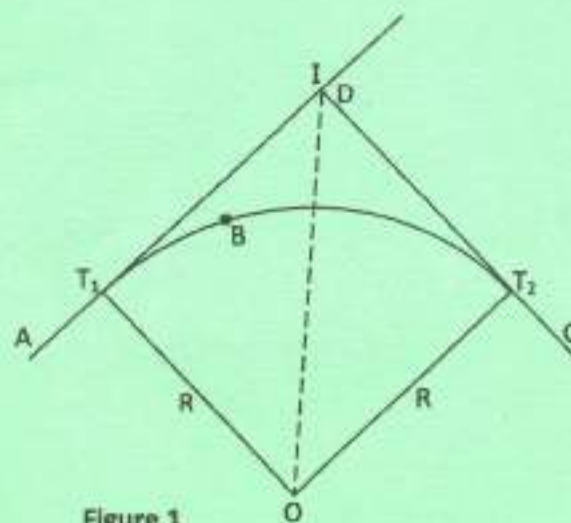
AI = 90° 30' 00"   IC = 110° 45' 00".

The straights are to be joined by a simple circular curve which must pass through point B which is 160 m from I. Given that the bearing of BI is 80° 30' 00 "; calculate:

(i)   the required radius of the curve;
(ii)   tangent lengths;
(iii)   length of the curve;
(iv)   setting out angle for a 30 m chord.

(14 marks)

Figure 1

8.   (a)   Define the following terms as used in earthworks:

            (i)   haul distance;
            (ii)   free haul;
            (iii)   balancing line;
            (iv)   bulking.

                                                                 (4 marks)

    (b)   State **eight** characteristics of mass haul diagrams.   (12 marks)

    (c)   **Figure 2** shows a 10 m square grid with depths of cut marked at each intersection.

            (i)   Determine the volume contained in the grid square A;
            (ii)   Sketch the 3-dimensional view of square grid B.

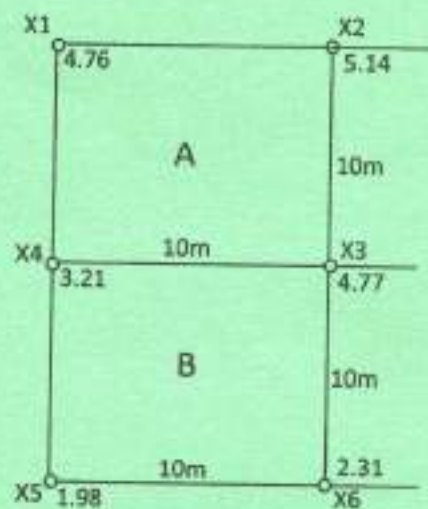   (4 marks)

Figure 2