

2306/302
SURVEYING
June/July 2018
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL
DIPLOMA IN QUANTITY SURVEYING

SURVEYING

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Scientific calculator.

Answer FIVE of the following EIGHT questions.

All questions carry equal marks.

Maximum marks for each part of a question are indicated.

Candidates should answer the questions in English.

This paper consists of 6 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

$$T = 2 \tan\left(\frac{\theta}{2}\right)$$

(a) Sketch and label six elements of a simple circular curve. (5 marks)

(b) Convert each of the following forward bearing to back bearing:

(i) $225^\circ 45'$;

(ii) $N 65^\circ 20' 15'' W$;

(iii) $S 45^\circ 32' 26'' E$. (3 marks)

(c) Two straights PI and QI meet at inaccessible point I. Point E and F were established on the straights PI and QI respectively such that the distance EF is 100 m. The angle PEF was measured as $165^\circ 40' 00''$ and QFE as $168^\circ 40' 00''$. If the radius of the curve and chainage of E are 600 m and 2530 m respectively:

(i) Calculate the distances from E and F to the respective tangent points.

(ii) Determine the chainage of the first and last tangent points. (12 marks)

2. A plot of land is bounded by three straight fences BC, CD and DA and an irregular hedge which lies entirely outside the quadrilateral ABCD. The following measurements were taken:

AB	=	112.4 m
BC	=	101.6 m
CD	=	131 m
DA	=	98.4 m
AC	=	137.8 m

Offsets were taken from AB to the irregular hedge as follows:

Point (M)	0	10	20	40	60	80	112.4
Offset (M)	0	3.2	8.4	11.7	13.3	5.1	0

Calculate the total area of the plot, using:

(i) Simpson's rule;

(ii) trapezoidal rule for the irregular part. (20 marks)

(a) Define each of the following terms as used in levelling:

(i) intermediate sight;

— All readings taken b/w B.S and I.S

(ii) reduced level;

— height above surface adopted as datum

(iii) line of collimation;

— line of sight defined by optical axis of ~~instrument~~ ^{of theodolite}

(iv) fore sight.

— This is the last sight taken before closing survey work. (6 marks)

(b) In running fly levels from a bench mark of reduced level 1500 m, the following readings were obtained:

Foresight: 1.050, 3.350, 2.155

Backsight: 1.215, 1.935, 1.880, 1.525

From the last position of the instrument, five pegs at 30 metre intervals are to be set out on a uniform rising gradient of 1 in 50. The first peg is to have a reduced level of 1497.245. Work out the staff readings required for setting the tops of the pegs on the given gradient. (14 marks)

4. Table 1 shows traverse angular observations. Given the following datum bearings, compute adjusted bearings for the traverse:

Datum Bearing:

FK3 – MF10: $261^{\circ} 44' 20''$

FK3 – TR 44: $330^{\circ} 05' 59''$

FK3 – TR 1: $00^{\circ} 21' 31''$

MF1 – FK2: $103^{\circ} 11' 05''$

MF1 – MF3: $266^{\circ} 48' 32''$

(20 marks)

1.50

1497.245

Table 1

Instrument Station	Observed station	Observed bearing
FK3	MF 10	261° 45' 03"
	TR 44	330° 06' 55"
	TR 1	00° 21' 49"
	MF 11	179° 03' 58"
MF 11	FK3	359° 03' 44"
	MF 12	139° 35' 08"
MF 12	MF 11	319° 35' 27"
	MF 13	143° 22' 34"
MF 13	MF 12	323° 22' 12"
	MF 14	152° 21' 58"
MF 14	MF 13	332° 22' 04"
	MF 15	273° 59' 26"
	MF 1	121° 19' 24"
MF 1	MF 14	301° 19' 32"
	FK 2	103° 10' 28"
	MF 3	266° 48' 06"

- (a) (i) Outline the two methods of obtaining linear measurements.
(ii) Explain the process of ranging when chaining. (7 marks)

- (b) Describe the three classes of errors encountered in chain surveying giving one example in each case. *- mistakes - due to carelessness (7 1/2 marks)* 12

- (c) (i) Determine the horizontal length of a chain measured as 215.95 m on a sloping ground of 05° 25'. *- systematic - how surveyor, steep sunny - accidental - unavoidable - human sight*
(ii) If the height difference between two points 60 m apart on a sloping ground is 2.25 m, evaluate the horizontal distance between them. (5 1/2 marks)

6. (a) With the aid of a sketch, explain the procedure of setting out the corners of a rectangular building using a theodolite and a tape. (9 marks)

- (b) A sewer line 180 m long is to be laid at a falling gradient of 1 in 100 from manhole X to manhole Y. The ground levels at X and Y are 1390.058 m and 1388.745 m respectively. If the invert level at Y is 1387.055 and the height of sight rail above the ground at Y is 2.00 m; determine:

- (i) length of the boring rod;
(ii) height of fixing the sight rail at X. (11 marks) 19
12
31

7. (a) Explain each of the following terms as applied to theodolite surveying:

- (i) swinging the telescope;
- (ii) centering;
- (iii) face right observations;
- (iv) transiting.

(9)
(6 marks)

(b) State three permanent adjustments carried out on a theodolite.

(3 marks)

(c) Using the tacheometric observations shown on table 2, determine each of the following:

- (i) the reduced levels of P, Q and R;
- (ii) the distances PQ, QR and PM.



Table 2

Instrument Station	Staff Station	Height of Instrument	Vertical Angle	Staff Reading	
				Mid	Top
P	M	1.50	-07° 12'	1.615	2.167
P	Q	1.55	+06° 05'	1.441	1.963
Q	R	1.62	+10° 30'	2.545	3.170
Tacheometric constants are 100 and 0 respectively and reduced level of M is 950 M.					

(11 marks)

8. (a) Outline the field procedure for determining the tacheometric constants.

(6 marks)

(b) Explain two types of obstacles in chain surveying giving one example in each case.

- ① obstacles to ranging
- ② obstacles to chaining

(5 marks)

(c) Convert each of the following whole circle bearings to quadrantal bearings:

- (i) 55° 35' 40";
- (ii) 295° 13' 52";
- (iii) 185° 35' 32".

10

(3 marks)

(d) Compute the join RS if the coordinates of R and S are:

$R: +10432.10 \quad +9864.50$

$S: +9785.40 \quad +11406.70$

(6 marks)

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