2312/306
SURVEY CONTROL AND
ENGINEERING SURVEYING
Oct./Nov. 2021
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN LAND SURVEYING

SURVEY CONTROL AND ENGINEERING SURVEYING

3 hours

INSTRUCTIONS TO CANDIDATES

*This paper consists of **SIX** questions in **TWO** sections **A** and **B**.*
*Answer any **FOUR** questions choosing at least **TWO** questions from each section in the answer booklet provided.*
*Each question in section **A** carries **30** marks while each question in section **B** carries **20** marks.*
Maximum marks for each part of a question are 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.

SECTION A: SURVEY CONTROL

*Answer any **TWO** questions from this section.*

1. **Figure 1** shows a transverse run between two datum points A and C.

(i) Use the information given in **figure 1** to prepare a bearing sheet.
(ii) Given the coordinates of the datum, coordinates in **table 1**, compute and adjust the traverse by the Bowditch's method. (30 marks)

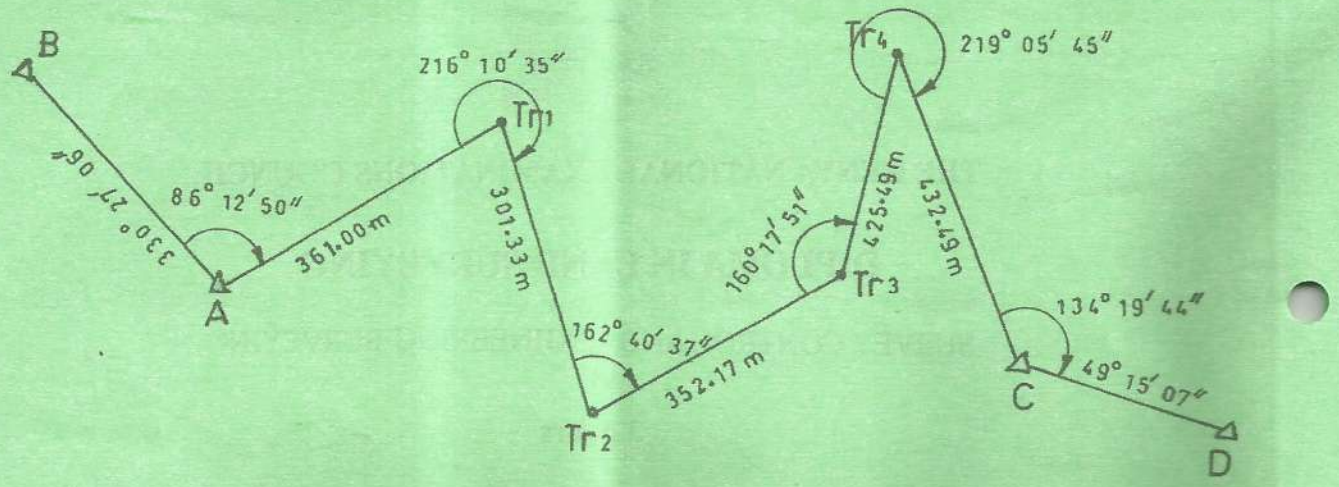

Fig.1

Table 1

Point	N (m)	E
A	+1291.64	+1898.36
C	+1764.89	+3625.07

2. (a) **Figure 2** shows a braced quadrilateral ABCD.

(i) Use the information in **figure 2** to show **three** independent angle conditions.
(ii) Prove that the side condition for the braced quadrilateral ABCD is given by:

$$\Sigma \text{logsin}\,"EVEN"angles = \Sigma \text{logsin}\,"ODD"angles$$

(13 marks)

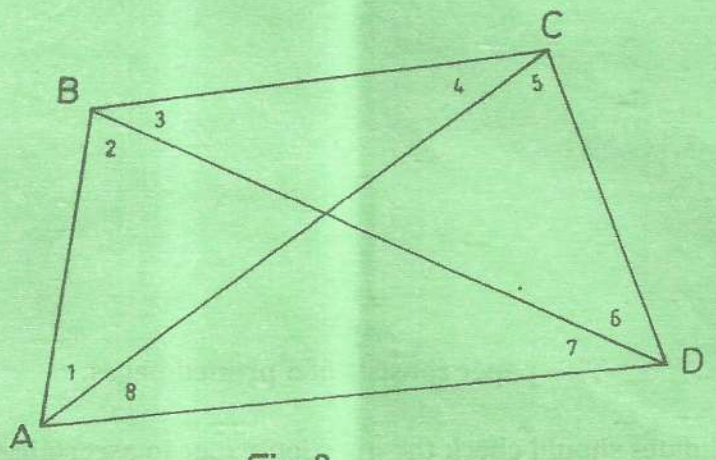

Fig.2

(b) **Figure 3** shows differences in height for heighting point T from points PT_1 and PT_2 by trigonometry. Determine the weighted mean height of T. If the heights of PT_1 and PT_2 are 1310.70 m and 1387.30 m respectively. (17 marks)

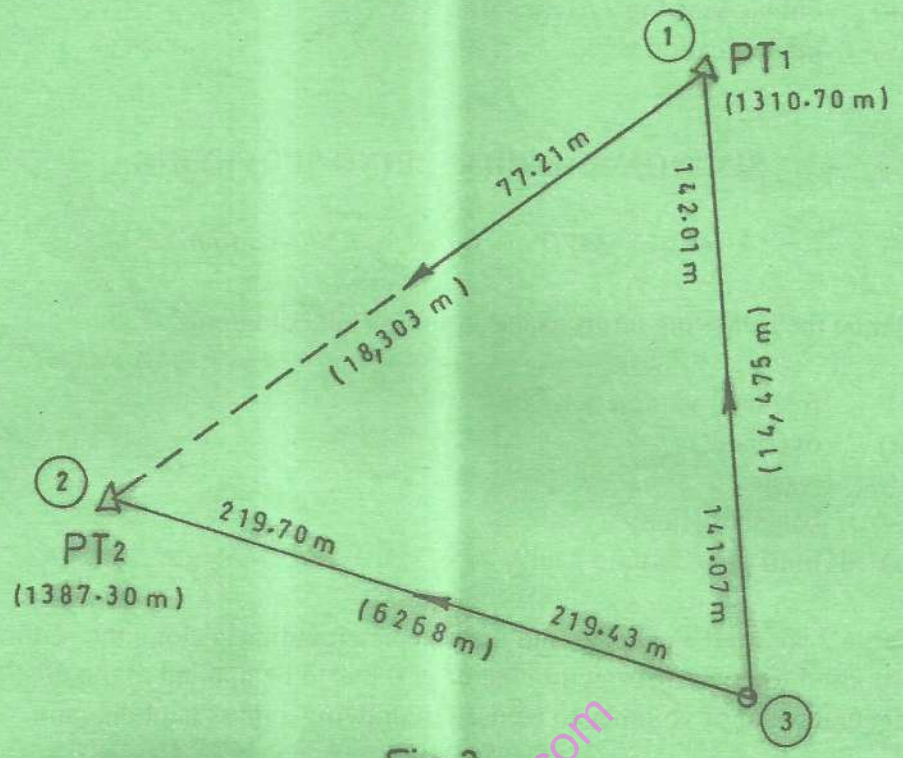

Fig. 3

3. (a) Define the following terms as used in field astronomy:

(i) celestial equator;
(ii) first point of aries;
(iii) right ascension;
(iv) prime vertical;
(v) spherical triangle. (5 marks)

(b) Explain the effect of the following on satellite signals:

(i) the atmospheric effects;
(ii) multipath effects. (6 marks)

(c) Describe the function of the control segment in Global Positioning System. (3 marks)

(d) Outline the double base method of altimetry in term of:

(i) instrumentation and personnel;
(ii) field procedure. (9 marks)

(e) Describe the requirements of a precise level in terms of the following:

(i) type of level;
(ii) radius of curvature;
(iii) bubble viewing system;
(iv) magnification. (7 marks)

SECTION B: ENGINEERING SURVEYING

*Answer **TWO** questions from this section.*

4. (a) Define the following terms as used in mass haul diagrams:

(i) free haul volume;
(ii) overhaul;
(iii) waste;
(iv) balancing line;
(v) limit of economic haul. (5 marks)

(b) **Table 2** shows the changes and the associated volumes along the centre line of a proposed road. If a correction factor of 0.8 is to be applied to the fills, determine the algebraic sum of volumes to be used in drawing a mass haul diagram. (9 marks)

Table 2

Chainage (m)	Volume (m^3)
50	0
51	+1860
52	+1525
53	+547
54	-238
55	-1080
56	-2025
57	-2110
58	-1120
59	-237
60	+362
61	+724
62	+430

(c) State:

(i) **three** applications of hydrographic surveying;

(ii) **three** factors affecting the verticality of wires in underground surveying.

(6 marks)

5. (a) State **six** factors on which the choice stopping distance of a moving vehicle depends in road construction.

(6 marks)

(b) A circular curve of radius 750 m has been set out connecting two straights with a deflection angle of 40°. Due to unavoidable circumstances, the midpoint of the curve has to be moved 6 m towards the centre. If the alignment of the straights remains unaltered, calculate:

(i) the radius of the new curve;

(ii) the distances from the intersection point to the new tangent points;

(iii) the deflection angle for setting out 30 m chords of the new curve;

(iv) the length of the new curve;

(v) the length of the final sub-chord.

(14 marks)

6. (a) **Figure 4** shows a length of a sewer line PQR to be constructed with a manhole at Q. If the manhole is to be set out for a point △ perpendicular to a street traverse line CE, use the information in **figure 4** and the coordinates in **table 3** to compute data for setting out the manhole.

(9 marks)

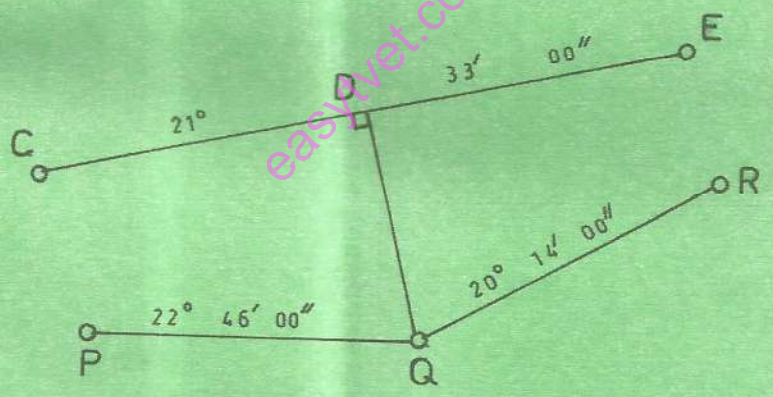

Fig. 4

Table 3

Point	N (m) E	
C	+1300.00	+1060.00
Q	+1448.62	+1127.05

(b) A cutting has a formation width of 12 m and the side slopes are 1 to 1 with a horizontal ground surface. If the vertical depths at the end of cross sections are 5 m and 7 m respectively, calculate the volume of the excavation between two cross sections 120 m apart by use of the prismoidal formula.

(11 marks)

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