

**THE KENYA POLYTECHNIC UNIVERSITY
COLLEGE**

DEPARTMENT OF SURVEYING & MAPPING

HIGHER DIPLOMA IN LAND SURVEY

END OF YEAR I EXAMINATIONS

NOVEMBER 2007

FIELD ASTRONOMY & PLANE SURVEYING

3 HOURS

INSTRUCTIONS TO CANDIDATES:

You should have the following for this examination:

Answer booklet

Scientific calculator

Computation forms (C/22)

This paper consists of **TWO** sections, **A** and **B**.

Answer any **TWO** questions from section **A** and any **THREE** from section **B**.

All questions carry equal marks and the maximum marks for each part of a question are as shown.

This paper consists of 4 printed pages.

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SECTION A: FIELD ASTRONOMY

Answer any TWO questions from this section.

1. (a) With the aid of diagrams, describe the following coordinate systems as used in field astronomy:
- (i) Right Ascension and declination
 - (ii) Hour angle and polar distance (10 marks)
- (b) Draw a celestial sphere and indicate the following:
- (i) Celestial equator
 - (ii) Ecliptic
 - (iii) First point of Aries
 - (iv) The astronomic triangle and its parts (10 marks)
2. (a) A star is said to be at prime vertical when the angle at the zenith (Z) is 90° .
- (i) Draw and label the astronomic triangle to indicate the above condition.
 - (ii) If the declination (δ) and the latitude (ϕ) of the observer are known, express the hour angle (t) and the altitude (H) in terms of δ and ϕ by applying the Napier's rules of circular parts. (8 marks)
- (b) (i) State the Legendre's Theorem as applied to spherical angles of a triangle.
- (ii) The sides of a spherical triangle are given as follows:
- AB = 26, 013.282m
BC = 13, 327.628m
AC = 22, 785.523m
- Determine the value of spherical excess (E) taking the radius of the earth as 6, 378, 249m. (12 marks)
3. (a) With the help of a diagram, show that the correction for refraction to observed altitude in field astronomy is given by $r = (\mu - 1) \cot h$, where:
- μ = refractive index
 h = observed altitude (15 marks)

(b) State **FIVE** advantages of Astro-fix in field astronomy. (5 marks)

SECTION B: PLANE SURVEYING

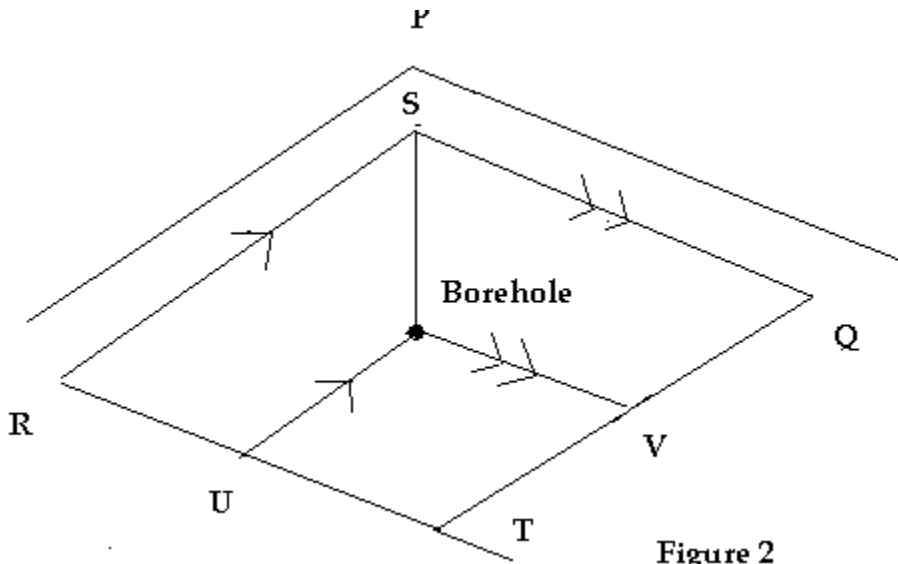
Answer any THREE questions from this section.

4. (a) Figure 2 shows a parcel of land. The parcel is to be divided into 3 portions such that the borehole falls at the common boundary. If PS and the borehole are to be on a straight line, explain how you would coordinate the borehole, 'U' and 'V' given the following information:

- Coordinates of R, Q, S and T
- Bearings: Borehole to V and borehole to U
- Distance S - borehole
- Line R-S is parallel to U-borehole (10 marks)

(b) Use the procedure stated in (a) above to compute:

- (i) Bearing of S-borehole
- (ii) Coordinates of borehole, U and V. (10 marks)



Datum coordinates:

R	10320.50	9835.20
S	10545.14	9903.81
Q	10345.24	10059.59
T	10340.21	9847.47

5. Outline:

- (i) **FIVE** corrections applied to long distances measured with an edm instrument.
- (ii) The procedure for calibrating an edm instrument using multi-pillar method.
- (iii) Components of cadastral surveying stating activities in each

(20 marks)

6. (a) Outline the provision of Survey Act with regard to the following:

- (i) Surveys of curvilinear boundary
- (ii) Missing beacons and re-establishment of lost boundary
- (iii) When a beacon cannot be placed. (12 marks)

(b) A government surveyor was forced to cut down a number of coffee trees to facilitate survey measurements. The land owner demanded for compensation for the cut down trees. If the two parties will agree on a fair compensation, outline the procedure followed to arrive at the fair compensation. (8 marks)

7. Figure 3 shows a parcel ABCDE. It is required to cut off an area of 0.7082Ha by a line ED whose bearing is $180^{\circ}00'00''$. Given:

Coordinates (m)

A: +396.70 +342.11

B: +388.13 +293.46

C: +304.80 +304.80

Bearings: AE = $110^{\circ}00'00''$

CD = $84^{\circ}30'00''$

Find lengths AE, CD and DE.

(20 marks)

Figure 3

