



THE KENYA POLYTECHNIC

SURVEYING & MAPPING DEPARTMENT

HIGHER DIPLOMA IN LAND SURVEY

END OF YEAR I EXAMINATIONS

NOVEMBER 2006

FIELD ASTRONOMY & PLANE SURVEYING

3 HOURS

INSTRUCTIONS TO CANDIDATES:

You should have the following for this examination:

Answer booklet

Scientific calculator

Survey computation forms

This paper consists of TWO sections, A and B.

Answer TWO questions from section A and THREE questions 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.

SECTION A: FIELD ASTRONOMY

Answer any TWO questions from this section.

1. (a) State FIVBE applications of field astronomical observations in land surveying. (5 marks)
 - (b) Draw a diagram of a celestial sphere indicating the following:
 - (i) Celestial equator
 - (ii) Co-latitude
 - (iii) Co-altitude
 - (iv) Co-declination
 - (v) Azimuth angle
 - (vi) Parallax angle
 - (vii) Hour angle (5 marks)
 - (c) With the aid of a diagram(s), describe the following spherical coordinate systems pointing out their reference planes:
 - (i) Altitude and Azimuth system
 - (ii) Declination and Hour Angle Systems. (10 marks)
2. With the help of a diagram, show that for any given spherical triangle ABC, the cosine formula is given by:
$$\cos a = \cos b \cos c + \sin b \sin c \cos A$$
Where: a, b and c are the sides of the triangle and A is the angle subtended by sides a and c. (20 marks)
3. (a) (i) Convert the following mean time intervals to their corresponding side real time intervals:
 - 13hrs 14min 36sec
 - 22hrs 44min 57.77(ii) Using a time diagram, explain how the relationship between mean and side real time is given by:
$$GST = GHA(Aries) = UT + R,$$
 where R is the Right Ascension of the mean sun. (10 marks)

(b) With the aid of a diagram, show that the correction for semi-diameter to solar observations is given by: $\Delta\alpha = d \operatorname{sech}$, where:

d = semi-diameter of the sun

h = observed altitude to the sun. (10 marks)

4. (a) Outline the field procedure of determining azimuth by observing altitudes to the sun. (15 marks)

(b) Show that in any given astronomical triangle ZPS, the formula for determining the azimuth of a celestial body S is given by:

$$\cos A = \frac{\sin d - \sinh \sin \phi}{\cosh \cos \phi} \quad (5 \text{ marks})$$

SECTION B: PLANE SURVEYING

Answer any THREE questions from this section.

5. (a) Outline the application of photogrammetric surveying in the preparation of RIM. (10 marks)

(b) (i) Outline the requirements of an ideal signal during triangulation surveys.

(ii) Explain the meaning of the term "phase error" as applied to signals in triangulation surveys. (10 marks)

6. (a) Discuss the types of boundaries in Cadastral survey. (9 marks)

(b) Outline the process of survey under RTA. (11 marks)

7. (a) Explain the principle of EDM measurements. (5 marks)

(b) (i) Explain the concept of modulation.

(ii) Describe THREE types of modulation using diagrams where necessary. (8 marks)

(c) The slope distance from X to Y corrected for meteorological conditions and EDM system constants is 921.050m. The EDM transmitter is 2.040m above the ground. The observed vertical angle is $-04^{\circ} 30' 00''$. The

theodolite and target are 1.940m and 2.000m respectively above the ground. Calculate the horizontal distance XY. (7 marks)

8. (a) Derive an expression that may be used to transform coordinates from one plane coordinate system to another allowing for change of scale, orientation and origin. (5 marks)

- (b) The coordinates of two points P and Q in a local and national system (both in meters) are as follows:

	Local system		National System	
P	3911.23	10,966.92	643,649.19	409,577.46
Q	2000.00	15,000.00	641,750.63	413,613.47

The local system coordinates of three other points are:

C	3,632.62	12,846.45
D	1,920.61	13,986.04
E	3,869.70	15,321.66

Compute the coordinates of C, D and E. (15 marks)