



THE KENYA POLYTECHNIC

SURVEYING & MAPPING DEPARTMENT

HIGHER DIPLOMA IN LAND SURVEY

END OF YEAR I EXAMINATIONS

NOVEMBER 2006

GEODESY

3 HOURS

INSTRUCTIONS TO CANDIDATES:

You should have the following for this examination:

Answer booklet

Calculator/Mathematical tables

Answer any FIVE of the following EIGHT questions.

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

This paper consists of 3 printed pages.

© 2006, The Kenya Polytechnic Examinations Office

Use Clarke 1880 ellipsoid whose parameters are $a = 6378293m$ $1/f = 294.3$ where applicable

1. a) "Geodesy is the science of measuring and portraying the earth's surface"
 - i) Criticize this classical definition in view of the scope of present day geodesy
 - ii) State the appropriate definition of geodesy (8 marks)
- b) Highlight the contributions of the following in the development of geodesy:
 - i) Thales
 - ii) Pythagoras
 - iii) Eratosthenes
 - iv) Aristotle (12 marks)
2. a) Outline the three sub-disciplines of geodesy (4 marks)
- b) Explain the following surfaces used in geodesy:
 - i) A plane
 - ii) A sphere
 - iii) A geoid (12 marks)
- c) Distinguish between bi-axial and tri-axial ellipsoids (4 marks)
3. With the aid of diagrams, explain different types of the following coordinates systems:
 - i) Geocentric
 - ii) Topocentric (20 marks)
4. a) i) Derive an expression for computing the second eccentricity in terms of the first eccentricity
- ii) Hence compute the second eccentricity for Clarke 1880 ellipsoid(8 marks)
- b) State:
 - i) Factors considered in the choice of a reference ellipsoid for different regions
 - ii) Parameters used to define a reference ellipsoid (12 marks)
5. a) i) With the aid of a diagram, derive the expression for computing the meridian coordinates of a point in terms of reduced latitude (7 marks)

- ii) Compute the meridian coordinates of a point whose reduced latitude is $45^{\circ} 13' 30''$ (5 marks)
- b) Show that $\tan\varphi = (1 + e')^{1/2} \tan\beta$ and hence calculate the geodetic latitude of a point whose reduced latitude is $40^{\circ} 13' 50''$ (8 marks)
6. a) Derive the expressions for computing the geodetic coordinate of a point in terms of rectangular coordinates. (10 marks)
- b) Compute the geodetic coordinates of a point whose Cartesian coordinates are:
- $X = 3\,976\,915.663\text{m}$
- $Y = -6\,269.199\text{m}$
- $Z = 4\,969\,845.956\text{m}$
7. a) Explain the principal normal sections used in geodesy. (5 marks)
- b) Derive an expression for computing the radius of curvature of the meridian section (15 marks)
8. With the aid of a diagram derive the expression for computing x-coordinate on an ellipsoidal meridian in terms of eccentricity, semi-major axis and geodetic latitude (20 marks)