THE KENYA POLYTECHNIC

SURVEYING & MAPPING DEPARTMENT

HIGHER DIPLOMA IN LAND SURVEY

END OF YEAR I EXAMINATIONS

NOVEMBER 2006

PHOTOGRAMMETRY & REMOTE SENSING

3 HOURS

INSTRUCTIONS TO CANDIDATES:

You should have the following for this examination:

Answer booklet

Unprogrammable calculator

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.

Illustrate your answers with neat sketches and use formulae whenever applicable.

This paper consists of 3 printed pages.

1. (a) Write down a formula for the 3-D similarity transformation (7-parameters). (2 marks)

   (b) Explain the parameters in this formula. (3 marks)

   (c) Use this formula to deduce the collinearity condition. (5 marks)

   (d) Explain the procedure to use this condition for the determination of the elements of exterior orientation of a single photograph (Space Resection). (10 marks)

2. The elements of relative orientation as functions of the measured y-parallaxes at the six standard points are given as:

$$\omega_1 = \frac{c}{4y^2}(-2q_1 - 2q_2 + q_3 + q_4 + q_5 + q_6);$$

$$\phi_1 = \frac{c}{2by}(q_6 - q_4); \qquad \phi_2 = \frac{c}{2by}(q_5 - q_3)$$

$$k_1 = \frac{1}{3b}\left[q_2 + q_4 + q_6 - \left(3c + \frac{2y^2}{c}\right)\omega_1\right]$$

$$k_2 = \frac{1}{3b}\left[q_1 + q_3 + q_5 - \left(3c + \frac{2y^2}{c}\right)\omega_1\right]$$

   (a) Discuss the effect of the values of c, b and y on the accuracy of these elements. (6 marks)

   (b) Find expressions for the errors in these elements due to errors in the y-parallaxes. (6 marks)

   (c) Assuming reasonable values for c, b, y and errors in q, calculate the errors in these elements. (8 marks)

3. (a) Define the meaning and objectives of aerial triangulation. (5 marks)

   (b) Explain the necessity of the triple-lap between photographs in a strip for the construction of aerial triangulation. (5 marks)

   (c) Outline the steps of carrying out aerial triangulation using universal instruments. (10 marks)

4. Discuss, giving examples, the different characteristics of analogue images, which could be used as criteria for photo interpretation. (20 marks)

5. Discuss, giving examples, the concept of resolutions of a remote sensing system. (20 marks)

6. From a 45.88m base line, two terrestrial photographs were taken with a camera of principal distance 101.24mm according to the normal case of photography. Two image points "a" and "b" appear on the photographs with the following measurements:

Point	x_1(mm)	X_2(mm)	$z_1=z_2$(mm)
a	+3.72	-44.46	-4.78
b	+26.59	-27.21	+13.04

   (i) Calculate the elevations of the object points A and B above the base and estimate their accuracies.

   (ii) Calculate the horizontal distance AB. (20 marks)

7. (a) Explain the necessity for determination of the coordinates of perspective centers at the projectors of a stereo plotter in the machine coordinate system when carrying out aerial triangulation by independent models.

   (b) Compute the coordinates of the perspective centre of a projector of a stereo plotter using the ΔZ method if the coordinates of two model points measured at two levels are:

	Z=50.00(mm)		Z=280.00(mm)	
Point	X(mm)	Y(mm)	X(mm)	Y(mm)
A	591.81	785.71	594.30	656.30
B	902.74	5050.10	762.31	504.55

(15 marks)

8. (a) What are the differences between images and photographs? (5 marks)

   (b) What is the meaning of atmospheric windows? (5 marks)

   (c) At which band-widths do atmospheric windows exist? (5 marks)

   (d) What advantages does SPOT have over Landsat? (5 marks)