

**NATIONAL EXAMS MAY 2014**  
**04-GEOM-A4, PHOTOGRAMMETRY**  
**3 HOURS DURATION**

**NOTES:**

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
- 2.
3. This is a CLOSED BOOK exam. Any non-communicating calculator is permitted.
- 4.
5. SEVEN (7) questions constitute a complete paper.
- 6.
7. Part A: Answer ALL questions from #1 through #5;  
Part B: Answer ONE of Questions #6 or #7;  
Part C: Answer ONE of Questions #8 or #9;
8. The marks assigned to each question are shown in brackets in the left margin.

**PART A - PLEASE ANSWER ALL QUESTIONS FROM #1 THROUGH #5**

(10) **Question 1**

Compute the corrected image coordinates for an image point  $\alpha$  located at  $x_a = 62.579$  mm and  $y_a = -80.916$  mm with respect to the photo fiducial axes, if the coordinates of the calibrated principal point are  $x_p = 0.008$  mm and  $y_p = -0.001$  mm and the radial distortion at this image location is  $\Delta r = -0.0021$  mm.

(15) **Question 2**

A pair of overlapping vertical photographs were taken from a flying height ( $H$ ) 1230 m above mean sea level (MSL). The photo-coordinates of two points A and B were measured on both photographs, with the  $x$ -photo axis parallel to the flight axis. For the left photograph the photo-coordinates are  $x_A = 53.41$  mm,  $y_A = 50.84$  mm,  $x_B = 88.92$  mm and  $y_B = -46.69$  mm. For the right photograph the photo-coordinates are  $x'_A = -38.26$  mm,  $y'_A = 50.84$  mm,  $x'_B = -7.06$  mm and  $y'_B = -46.69$  mm. The  $x$ -coordinates of a point C along the flight line axis are  $x_c = 14.3$  mm and  $x'_c = -78.3$  mm for the left and right photograph, respectively. If the elevation of point C is 590 m above mean sea level, determine the elevations of points A and B.

(15) **Question 3**

A horizontal stereo-pair of photographs was captured with a terrestrial stereometric camera having a fixed base of 1.20 m and common focal length of 64 mm. The orthometric height of the perspective centers of both cameras is 100 m. The corrected photo-coordinates of two points  $a$  and  $b$  measured on the left photograph are:  $x_a = 31.40$  mm and  $y_a = 23.75$  mm;  $x_b = 5.10$  mm and  $y_b = -4.25$  mm. The  $x$ -coordinates measured on the right photograph are  $x'_a = 28.00$  mm and  $x'_b = -8.25$  mm. If the camera base is parallel to the  $X$  ground-axis with its positive direction being from the left to right camera and the planimetric ground coordinates of the left perspective center are  $X_L = Y_L = 100$  m, determine (a) which point is closer to the camera base and (b) the slope distance  $AB$ .

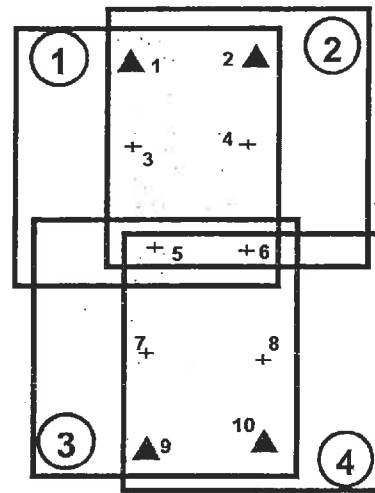
(20) **Question 4**

Derive the parallax equations from the collinearity equations.

(20) **Question 5**

A simultaneous bundle adjustment aerotriangulation is to be performed for a block of four overlapping images shown in the adjacent figure. The control points are to be held fixed.

- 5.1) List the type and give the number of unknowns (5)
- 5.2) List the type and give the number of measurements (6)
- 5.3) Give the mathematical basis and give the number of equations (6)
- 5.4) Give the statistical degrees of freedom (3).



▲ 3D control points  
+ Pass/tie points

**PART B - PLEASE ANSWER ONLY ONE OF QUESTIONS #6 OR #7**

(10) **Question 6**

- 6.1) What is a true orthophoto? (3)
- 6.2) What input data is required to generate a digital orthoimage? (3)
- 6.3) Describe the approach for orthoimage generation. (4)

(10) **Question 7**

- 7.1) What is image matching and where it is used in photogrammetric operations? (5)
- 7.2) Describe two methods of image matching used in digital photogrammetry. (5)

**PART C - PLEASE ANSWER ONLY ONE OF QUESTIONS #8 OR #9**

(10) **Question 8**

Define the following:

- 8.1) Nodal points, (2)
- 8.2) Relief displacement, (2)
- 8.3) Interior orientation, (2)
- 8.4) Exterior orientation, (2)
- 8.5) Direct georeferencing. (2)

(10)

**Question 9**

Define the following:

- 9.1) Depth of field, (2)
- 9.2) Vanishing points, (2)
- 9.3) Camera self-calibration, (2)
- 9.4) Absolute orientation, (2)
- 9.5) Space resection. (2)