UNAM
UNIVERSITY OF NAMIBIA

FACULTY	AGRICULTURE, ENGINEERING AND NATURAL SCIENCES		
DEPARTMENT	ENVIRONMENTAL SCIENCES		
SUBJECT	PHOTOGRAMMETRY		
SUBJECT CODE	GRS3751		
DATE	JUNE 2022		
DURATION	3 HOURS	MARKS	100

Supplementary / Special Examination

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This question paper consists of three (3) pages excluding this front page.

Instructions

1. Work in an orderly way and present your work as neatly as possible.
2. Mark your questions correctly and clearly.
3. Answer all questions.
4. The use of a calculator is allowed.

QUESTION 1 [15]

1.1 State whether each of the following statements is True or False:
  a. The principal application of photogrammetry lies in the production of topographic maps in the form of both line maps and orthophoto maps. (1)
  b. The scale of an oblique photograph is not uniform across the entire image. (1)
  c. A DTM can be defined as the elevation above the terrain which includes the height of natural and man-made features. (1)
  d. One advantage of contour lines is that they allow us to show the shape of the land surface on a map. (1)
  e. Linear interpolation is a logical method of estimating the unknown elevation of a point that falls between known points. (1)

1.2 Demonstrate your understanding of the following terms:
  a. Exposure station (2)
  b. Focal plane (2)
  c. Mass points (2)
  d. Interpolation (2)
  e. Bundle Adjustment (2)

QUESTION 2 [55]

2.1 Analyse the elevation representation in figure 1 below and answer questions that follow.

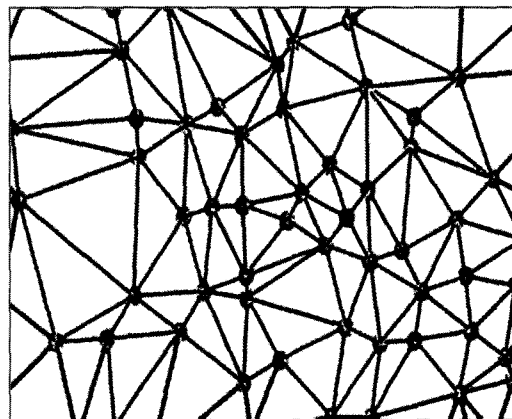
Figure 1: A type of elevation representation.

  a) What type of elevation representation is illustrated in figure 1 above? (1)
  b) Describe how that representation is formed. (4)

2.2 Highlight the primary difference between high and low oblique aerial photographs. (2)

2.3 Explain the difference between the two distinct areas of photogrammetry. (4)

2.4 Briefly describe interior image orientation highlighting its function(s) as well as what happens during this process. (4)

2.5 During orientation process of the photogrammetric project, there are a number of transformations that are taking place such as Affine and Similarity. Indicate how many parameters and what are those parameters for each of the following transformation:

      a. Similarity Transformation (4)
      b. Affine Transformation (5)

2.6 Identify the properties of affine transformation. (3)

2.7 Your classmate missed the class where optics was discussed. Make your classmate understand the difference between Geometric Optics and Physical Optics. (4)

2.8 What are the four expected qualities when producing orthophotographs? (4)

2.9 You are charged with the leading role on the photogrammetric flight planning project over the Havana informal settlements. Make your junior team members understand the project by answering the questions below.
    a) Explain the importance of planning the flight before commencing with the actual flight of the area. (6)
    b) State the five basic mission calculations performed during flight planning. (5)
    c) What is the importance of calibrating an aerial camera? (3)
    d) Evaluate the pros and cons of using GPS and INS as complementary systems against the use of GPS only during aerial photographs flight mission. (6)

QUESTION 3

3.1 With the help of Figure 2 below and using the relief displacement formula, find the height of the building (h) given the following parameters: flying height (H) above the base of the building is 1500 m for a vertical photograph. When measuring the image, the relief displacement of the building (d) is 40 mm and the radial distance from the principal point to the top of the object (r) is 750 mm. (3)
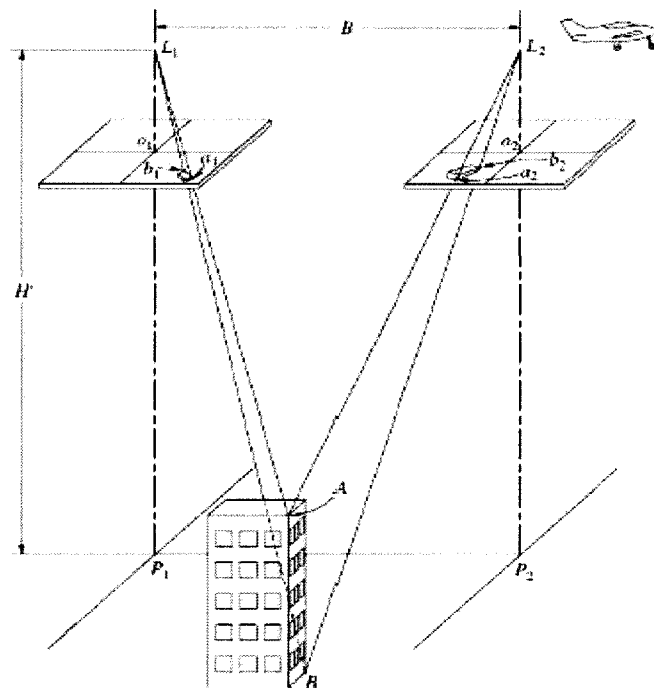

Figure 2: Photographs from two exposure stations with a building in common overlap area.

3.2 An object located 1.8 m in front of a thin lens has its image in focus 72.5 mm from the lens on the other side. Calculate the focal length of the lens. (4)

3.3 A single ray of light travelling through air (n=1.0003) enters a convex glass lens (n'=1.52) having a radius of 3.5 cm. If the light ray is 1.5 cm above the optical axis of the lens, calculate the angles of incidence Φ and refraction Φ' for the air-to-glass interface. (4)

3.4 UNAM has requested you to produce a flight plan for its main campus and the surrounding area which is to be mapped soon. Metric photographs are to be taken by a standard WILD metric camera to map the area. The size of the area to be mapped is 5 km by 3 km. Given the following, principle distance (c) = 152.4 mm, flying height above average ground (H) = 762 m, normal case photogrammetry = 60% end lap and 30% side lap, and standard photograph format of 230 mm, calculate the total number of photographs required for the whole project area. (Note: Marks are allocated for each correct step leading to the total number of photographs). (19)