The University of Zambia
School of Engineering
Department of Geomatic Engineering
2016/2017 Academic Year Term 3 Test

GEE 3622: Principles of Data Acquisition and Processing

Friday 21st July, 2017

Instructions

1. This TEST is Closed Book
2. Calculators are permitted
3. Time allowed is Two (2) Hours
4. **Answer: A TOTAL OF FOUR QUESTIONS: ANSWER ALL FROM SECTION (A) AND ONE FROM SECTION (B)**
5. Show all the work leading to the solution
6. Total marks for this TEST paper is 100

SECTION A

Question One (10+5+10 marks)

a. A single ray of light travelling through air (index 1.0003) enters a convex glass lens (index 1.575) having a radius of 47.5 mm. If the light ray is parallel to and 9.5 mm above optical axis of the lens, what are the angles of incidence and refraction?

b. With the help of a sketch, explain the term 'Parallactic angle' and state how it affects object distances.

c. Provide the definition of collinearity condition and give its mathematical expression. Explain the terms used in the mathematical expression.

Question Two (14+4+7 marks)

a. Briefly, define the following photogrammetric terms:
   - Pallarax
   - Principal Point
   - Illuminance
   - Exposure Station
   - Interior orientation parameters
   - Exterior orientation parameters
   - Fiducial Marks

b. Briefly, state the main difference between a map and a photograph.

c. State briefly, the relationships between?
   - f-number and shutter speed
   - Film speed and emulsion grain size
   - Resolution and emulsion grain size

Question Three (20+5 marks)

a. Assuming the principle point to be at the intersection of lines joining opposite corner fiducial points, calculate the coordinates of those fiducial points in the conventional xy coordinate system if their comparator coordinates XY are as in the table below.

Fiducial points	X(mm)	Y(mm)
A	87.294	210.223
B	199.826	96.996
C	313.054	209.555
D	200.512	322.768

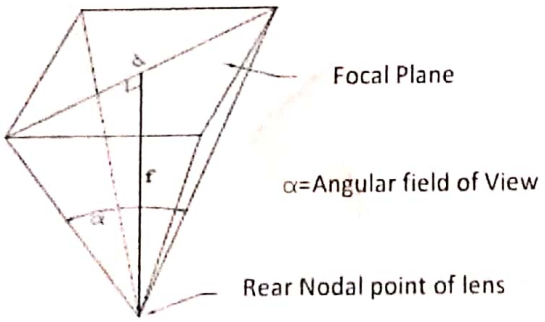
$(y_2 - y_1) = m(x_2 - x_1)$

$y = mx_1 + c_1$

$y = mx_2 + c_2$

$A = A' - o'$

b. The figure below shows the angular field of view of a camera. Calculate the angular field of view for a nominal 152-mm focal-length camera with a 23cm square format. State whether this is a wide angle, normal angle or super-wide angle type of a single-lens frame camera.



SECTION B

Question Four (15+10 marks)

a. With the help of sketches, show how stereoscopic coverage is lost due to
   i) Tilt
   ii) Unequal flying heights
   iii) Terrain variations

b. Air base of a stereopair is 1400m and flying height above ground is 2400m. Camera has a 152.4 mm focal length and 23-cm format.
   i) What is the percent end lap?
   ii) Assuming spacing between adjacent lines is 2500m, what is the percent side lap?

c. An aerial camera with IMC (Image Motion Compensation) is used to acquire photography at a flying height of 5200 m above ground. The focal length is 153.15 mm. The aircraft is flying at 325 km/hr and an exposure time of 1/250 second is used. How far across the focal plane must film travel during the exposure in order to obtain an image with no image motion blurring?

Question Five (4+6+15 marks)

a. What is relief displacement?

b. A vertical photo is taken from a height of 535 m above the datum. The elevation of the base of tower is 259m and the relief displacement'd' is measured as 54.1 mm. The radial distance to the top of the tower is 121.7 mm. What is the height of the tower?

c. The length of line AB and the elevation of its endpoints, A and B, are to be determined from a stereopair containing images a and b. The camera used to take the photographs has a 152.4-mm lens. The flying height was 1200 m (average for the two photos) and the air base was 600 m. The measured photographic coordinates of points A and B in the "flight line" coordinate system are x_a = 54.61 mm, x_b = 98.67 mm, y_a = 50.80 mm, y_b = -25.40 mm, x'_a = -59.45 mm, and x'_b = -27.39 mm. Find the length of line AB and the elevations of A and B.