



MACHAKOS UNIVERSITY

University Examinations for 2020/2021 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

THIRD YEAR SPECIAL/ SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 311: SURVEYING IV

DATE: 25/3/2021

TIME: 8.30-10.30 AM

INSTRUCTIONS

Answer Question One and Any Other Two Questions

QUESTION ONE (30 MARKS)

- a) Define the following terminologies as used in photogrammetry (5 marks)
- Base lining
 - X-parallax
 - Stereoscopy
 - Forward compensation mechanism
 - Parallactic angles for points
- b) Explain how the optical method is used to connect and orient the underground control networks into the same coordinate system as the surface networks. (3 marks)
- c) Two points A and B situated 10 and 40 m, respectively, above datum, are imaged on a near-vertical aerial photograph, taken from an altitude of 2000 m with a camera of focal length 152 mm. The photo coordinates of the points about the fiducial axes are measured as follows:

	x (mm)	y (mm)
a	+50.00	+100.00
b	-100.00	+80.00

If the tilt and swing of the photograph are 2° and 20° , respectively, calculate the horizontal ground distance AB. (5 marks)

- d) In a pair of overlapping photographs, (mean photo base length 89.84 mm) the mean ground level is 70 m above datum. Two nearby points are observed and the following information obtained:

Point	Height above datum (m)	Parallax bar reading (mm)
X	55	7.34
Y		9.46

If the flying height was 2200 m above datum and the focal length of the camera was 150 mm find the height of Y above datum. (4 marks)

- e) Calculate the approximate number of photographs required for stereographic coverage (60% forward overlap & 25% side overlap). Consider a photographic scale of 1:30,000, ground area coverage of 30 km by 45 km & a photographic standard format size of 230 mm $\times$ 230 mm (4 marks)
- f) Outline the camera constants obtained from the calibration process (3 marks)
- g) The image coordinates of three points A, B and C and of the principle points P and Q on two overlapping photographs were determined as follows:

	Left photo		Right photo	
	x (mm)	y (mm)	x (mm)	y (mm)
P	0.0	0.0	-76.2	0.0
Q	+76.0	0.0	0.0	0.0
A	+10.6	+60.5	-66.0	+59.0
B	+11.2	-6.3	-64.5	-6.7
C	+14.5	+34.3	-61.5	+33.7

If the ground coordinates of A and B are 79 000 mE, 92 940 mN and 78 910 mE, 92 760mN respectively, estimate those of C. (6 marks)

QUESTION TWO (20 MARKS)

- a) What is the objective of photogrammetric orientation? (2 marks)

- b) Given that the distance between point A and B on a topographic map is 4.75 cm, at a scale of 1: 50,000, and the distance between the same points on an air photograph is 23.07 cm, calculate the photographic scale (3 marks)
- c) Describe the various steps in photogrammetric orientation (15 marks)

QUESTION THREE (20 MARKS)

- a) Explain how the weisbach triangle method is used to connect and orient the underground control networks into the same coordinate system as the surface networks. (10 marks)
- b) From Figure 1 below, the national grid (NG) bearing of an underground base line, CD, is established by co-planning at the surface onto two wires, W1 and W2, hanging in a vertical shaft, and then using a Weisbach triangle underground. The measured field data is as follows:

NG bearing AB: $74^{\circ} 28' 34''$, NG coordinates of A: E 304 625 m, N 511 612 m, the horizontal angles: $\angle BAW_s 284^{\circ} 32' 12''$, $\angle AW_sW_2 102^{\circ} 16' 18''$, $\angle W_2W_uW_1 0^{\circ} 03' 54''$, $\angle W_1W_uC 187^{\circ} 51' 50''$, $\angle W_uCD 291^{\circ} 27' 48''$ and the horizontal distances: W_1W_2 3.625 m, W_uW_2 2.014 m. Compute the bearing of the underground base. (10 marks)

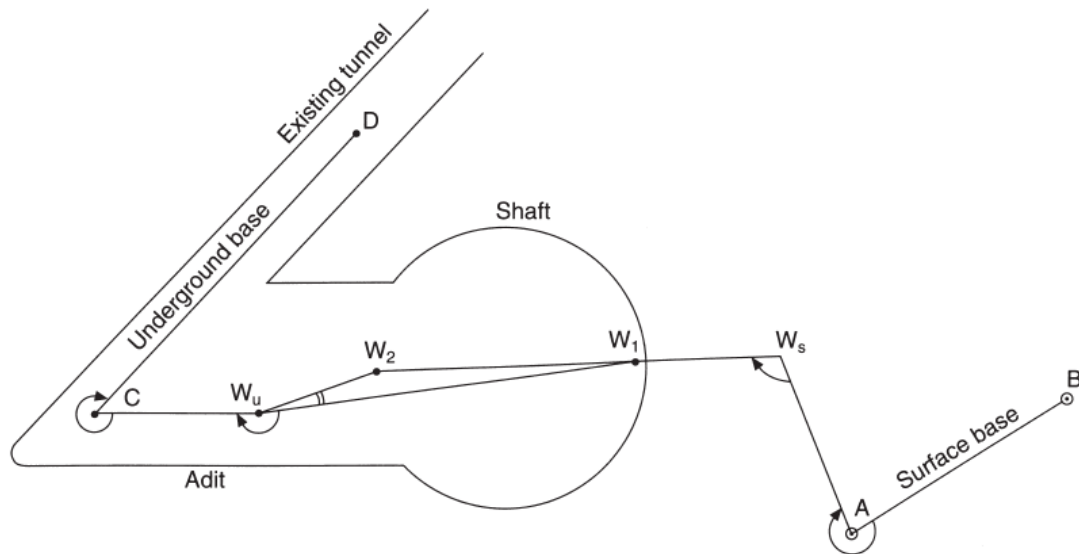


Figure 1

QUESTION FOUR (20 MARKS)

- a) In the Figure 2, for a certain photograph, $H = 1200\text{m}$, $f = 152$, vc is measured as 88.36 mm and vb as 90.78 mm :

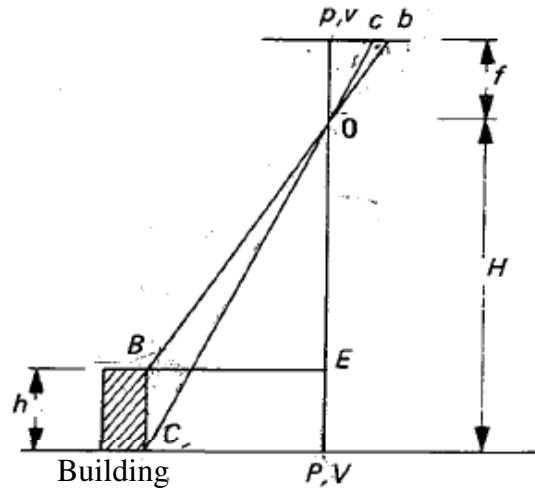


Figure 2

- Derive an equation for the displacement bc
 - Estimate the height of a building (5 marks)
- b) Explain three applications of photogrammetry in Civil Engineering (15 marks)

QUESTION FIVE (20 MARKS)

- Outline the two basic tasks involved in hydrographic surveys. (1 mark)
- With the aid of a well labelled diagram, define the most commonly used terms in a near vertical photograph with the optical axis tilted at θ to the vertical. (9 marks)
- Describe procedures for mapping water bodies. (10 marks)