



MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING AND CIVIL ENGINEERING
THIRD YEAR SECOND SEMESTER EXAMINATION FOR
BACHELOR OF SCIENCE (CIVIL ENGINEERING)
ECV 311: SURVEYING IV

DATE: 21/5/2019

TIME: 2:00 – 4:00 PM

INSTRUCTIONS: Attempt questions **ONE** and any other **TWO** questions.

QUESTION ONE (COMPULSORY) (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:

	<i>Left photo</i>		<i>Right photo</i>	
	<i>x (mm)</i>	<i>y (mm)</i>	<i>x (mm)</i>	<i>y (mm)</i>
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, W_1 and W_2 , 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: BAW_s $284^\circ 32' 12''$, AW_sW_2 $102^\circ 16' 18''$, $W_2W_uW_1$ $0^\circ 03' 54''$, W_1W_uC $187^\circ 51' 50''$, 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)

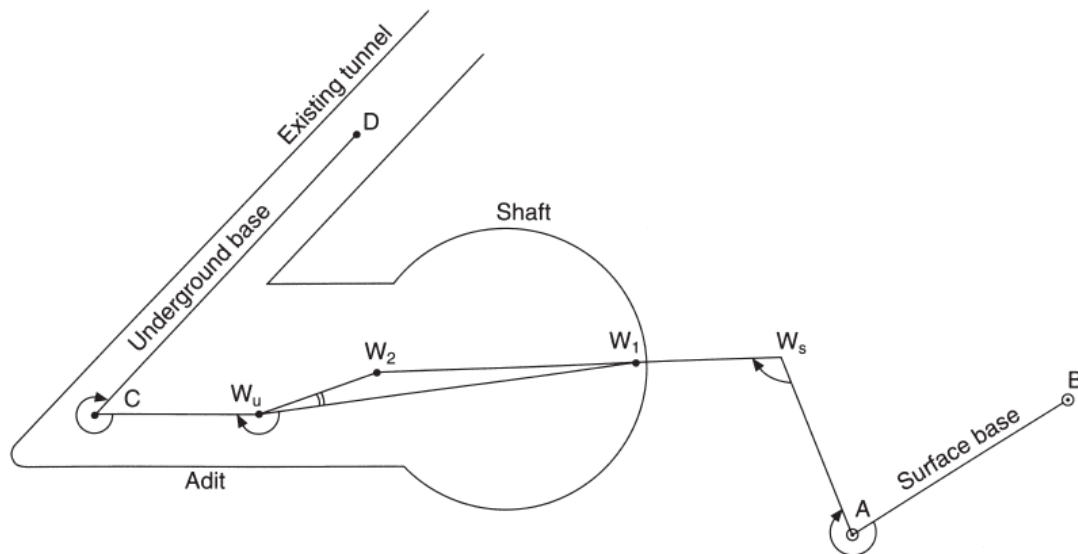


Figure 1

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:

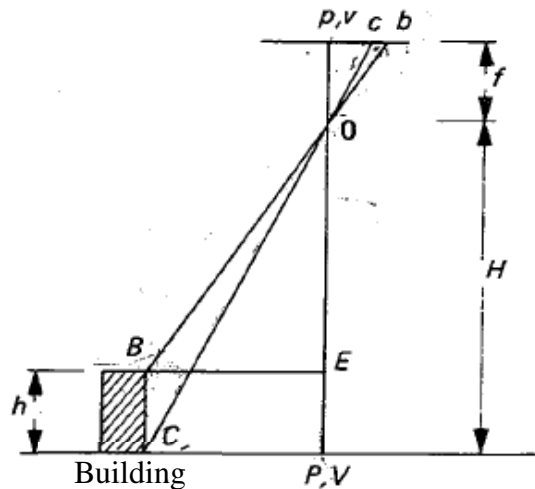


Figure 2

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

QUESTION FIVE (20 MARKS)

- a) Outline the two basic tasks involved in hydrographic surveys. (1 mark)
- b) 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)
- c) Describe procedures for mapping water bodies. (10 marks)