



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL DIPLOMA

IN

**URBAN AND REGIONAL PLANNING/SURVEYING AND GEOMATICS/CIVIL
ENGINEERING**

SUBJECT: Engineering Surveying

PAPER NO: 573/15/S07

DURATION: 3 hours

MARCH/APRIL 2021 EXAMINATION

REQUIREMENTS

1. Scientific Calculator.
2. Answer booklet(s).

INSTRUCTIONS TO CANDIDATE

1. Answer any five (5) questions.
2. All questions carry equal marks.

This paper consists of 4 printed pages.

QUESTION 1

- a) Write brief notes on the accuracy of an EDM instrument. (5 marks)
- b) Describe the two main classifications of EDM instruments. (10 marks)
- c) Explain the measuring Principle of an EDM. (5 marks)

QUESTION 2

- a) State two (2) ways by which horizontal curves are designated. (2 marks)
- b) If a curve is found to be a 4° curve on a $30m$ arc, find:
 - i) The tangent distance (2 marks)
 - ii) Length of long chord (2 marks)
 - iii) Length of arc (2 marks)
 - iv) Apex distance (2 marks)
 - v) Mid-ordinate if the deflection angle is 36° (2 marks)
- c) A vertical curve lies between two gradients of 0.4% and -0.6% . The RL of the point of intersection is $385.5m$. A vertical parabolic curve has to be introduced in the gradients. The rate of change of gradient is 0.05% per $20m$. Find the length of the curve and chord gradients for half of the curve (rising curve) and the elevation of points on the curve at $20m$ intervals. (8 marks)

QUESTION 3

- a) State the importance of calculating earthworks. (5 marks)
- b) State the use of a planimeter and explain how it is used. (5 marks)

- c) Using the data given in Figure 1, calculate the volume of water in the lake between the 525m and 555m contours. (10 marks)

Contour (m)	Enclosed area (m^2)
520	16 429
525	17 583
530	19 875
535	23 779
540	20 657
545	21 398
550	16 322
555	18 746
560	19 418

Fig. 1

QUESTION 4

Zenith angles observed from a station “P” to 3 trig beacons are recorded below.

Line	Zenith angle	Object	Height of signal
P-23/T	89.13.09	T.O.P	0.90m
P-382/T	86.33.38	T.O.P	0.90m
P-101/T	88.07.00	T.O.P	0.90m

Distance	Reduced levels	(MSL)
From P to 23/T= 5580.46m	23/T= 1571.60	T.O.P
to 382/T= 970.09m	382/T= 1552.60	T.O.P
to 101/T= 1411.09m	101/T= 1539.80	T.O.P

Other data:

- Radius of the earth = 6361.1km
- Co-efficient of refraction = 0.12
- Instrument length = 1.285
- Mean height of area = 1.500m

Calculate the mean elevation of P.

(20 marks)

QUESTION 5

- a) Explain why high rise buildings need constant deflection and deformation monitoring. (4 marks)
- b) Describe why deflection and deformation surveys are conducted during the construction stage and before construction commences. (6 marks)
- c) Given the option of either using a total station or a global positioning system (GPS), explain the reasons for your choice of instrument in carrying out deformation surveys. (10 marks)

QUESTION 6

- a) With the aid of sketches, describe the following methods of tide measurement:
 - i) Staff gauge (3 marks)
 - ii) Float gauge (3 marks)
 - iii) Weight gauge (3 marks)
 - iv) Self registering gauge (3 marks)
- b) Define the term sounding and list any five (5) pieces of equipment used for sounding. (8 marks)

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