higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

BUILDING AND STRUCTURAL SURVEYING N5

(8060045)

19 November 2024 (X-paper)
09:00–12:00

This question paper consists of 5 pages, 1 information sheet and 1 formula sheet.

012Q1E2419

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
BUILDING AND STRUCTURAL SURVEYING N5
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Start each section on a new page.
5. Use only a black or blue pen.
6. Write neatly and legibly.

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SECTION A

QUESTION 1: BASIC CONCEPTS

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1–1.5) in the ANSWER BOOK. Give ONE REASON for each answer.

1.1 A plane is a surface on which any straight line joining two points on it will not touch the plane completely.

1.2 Cadastral surveying is for the preparation of maps showing and defining legal property boundaries.

1.3 Compass surveying is used to locate points by measurement of compass bearings.

1.4 A horizontal plane is one at right angles to the direction of gravity at any one point

1.5 A vertical plane is one at 60° to a horizontal plane.

(5 × 2) **[10]**

QUESTION 2: LINEAR MEASUREMENT

2.1 Name FIVE requirements to obtain sufficient accuracy when taping. (5)

2.2 List FOUR advantages of chain surveying. (4)

2.3 A steel tape was used to measure baseline A–B. Calculate the reduced horizontal distance of the baseline. The measurement was taken in three bays.
Measured distance: A–B 198,57m/86°35′10″ @ 25°C
The following data were given:

- Length of the tape 100 m
- Mass of the tape 1,5 kg
- Standard temperature 20° C
- Coefficient of expansion $1{,}13 \times 10^{-5}$/°C
- Standard pull 70 N
- Radius of the earth 6 373 km
- Mean sea level below sea level 2 000 m

(11)
[20]

QUESTION 3: HEIGHT MEASUREMENT

3.1 Explain FIVE personal errors that one can make when levelling. (5)

3.2 Reduce the levelling information in TABLE 1 (attached) to obtain elevations of points A to F using the rise and fall method. Do the necessary checking for errors but do not make any corrections. Do all your calculations on TABLE 1. Enter your STUDENT NUMBER in the spaces provided and submit TABLE 1 with your ANSWER BOOK. (15)
[20]

QUESTION 4: ANGULAR MEASUREMENTS

4.1 Explain each of the following terms used when measuring with a theodolite:
- Centring
- Circle left
- Swinging the telescope
- Change face
- Transiting the telescope (10)

4.2 The following presented in the table below were obtained from survey station R. Calculate the mean observed angle, corrections and correct angle BRC, CRD, DRE and ERB. Check the calculations. Redraw and complete the table in your ANSWER BOOK.

Target station	Circle left	Circle right	Mean angle	Corrections	Correct angle
B	07:00:40	187:01:00			
C	96:43:20	276:43:00			
D	187:22:10	07:21:50			
E	204:15:15	24:15:39			
B	07:01:00	187:00:26			

(10)
[20]

TOTAL SECTION A: 70

SECTION B

QUESTION 5: BUILDING SURVEYS

The information in the table below refers to a drain between points A and B. The depth of the excavation at A is 1,84 m and the fall from A to B is 1:50. Calculate the cut and fill required in metres.

	Chainage	Ground levels	Invert levels	Cut (+)	Fill (-)
A	0	50,76		1,84	
	20	50,00			
	40	47,16			
	45	48,75			
B	60	49,57			

[10]

QUESTION 6: SETTING OUT

6.1 A tilting level is to be used to set out drainage between manholes M1 and M2 using the data below. Calculate the staff readings necessary to locate the sight rails over M1 and M2.

- Length of the drain = 225 m
- Gradient M1–M2 falls from M1 to M2 at 0,95 per cent
- Ground level at M1 = 229,38 m
- Depth of the excavation at M1 = 0,90 m
- Length of the traveller = 1,90 m
- Elevation of the benchmark = 230,31 m
- Backsight reading = 1,60 m (10)

6.2 Explain how profiles are used with a traveller to control excavation and foundation levels. (10)

[20]

TOTAL SECTION B: 30
GRAND TOTAL: 100

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TABLE 1

EXAMINATION NUMBER: | | | | | | | | | | | | | |

BACK SIGHT	INTER. SIGHT	FORE SIGHT	RISE	FALL	REDUCED LEVEL	REMARKS
2,51						BM 67, 65
1,54		2,32				A
	1,47					B
1.32		2,92				C
	1,43					D
1,32		1,52				E
		1,05				F

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BUILDING AND STRUCTURAL SURVEYING N5

FORMULA SHEET

Any applicable formula may also be used.

$\Delta h = 50I\sin 2\theta + HI - MH = 100I\sin\theta\cos\theta + HI - MH$

or

$V = -KS\ Cos\theta\ Sin\theta$

$HD = 100I\cos^2\theta$ of $KS\cos\theta$

$Ct = L.e.(Tm - Ts)$; $Ct = L.e\ (Tm - Ts)\ of\ L[1 + e\ (Tm - Ts)]$

$$\alpha = \tan^{-1}\frac{\Delta y}{\Delta x}$$

$$\alpha = \tan^{-1}\frac{\Delta x}{\Delta y} + 90\,°$$

$$\alpha = \tan^{-1}\frac{\Delta y}{\Delta x} + 180°$$

$$\alpha = \tan^{-1}\frac{\Delta x}{\Delta y} + 270°$$

$$S = \frac{\Delta y}{\sin\alpha}$$

$$S = \frac{\Delta x}{\cos\alpha}$$

$\Delta y = s.\sin\alpha$

$\Delta x = s.\cos\alpha$

)h = 50I sin 22 + HI - MH = 100I sin2 cos2 + HI - MH

$$V = \frac{d}{3}[(y_1 + y_n) + 2(y_3 + y_5 + ... + y_{n-2}) + 4(y_2 + y_4 + ... + y_{n-1})]$$

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