higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

CIVIL AND STRUCTURAL STEEL WORK DETAILING

(First paper)

NQF LEVEL 4

(12050674)

27 November 2020 (X-paper)
09:00–11:00

REQUIREMENTS: **A3 drawing sheet**
Standard hot-rolled structural steel sections (BOE 8/1)

Calculators and drawing instruments may be used.

This question paper consists of 5 pages and 1 addendum.

122Q1N2027

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TIME: 2 HOURS
MARKS: 75

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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QUESTION 1: CALCULATIONS FOR CIVIL AND STRUCTURAL STEEL WORK

1.1 Determine whether a 254 × 254 × 73 H-section will be sufficient to withstand an unfactored compression load of 9 000 kN. The column is fixed at the bottom and free on top. The strength of the steel is 350 MPa. E = 200 GPa, L = 7 000 mm and K = 2. (8)

1.2

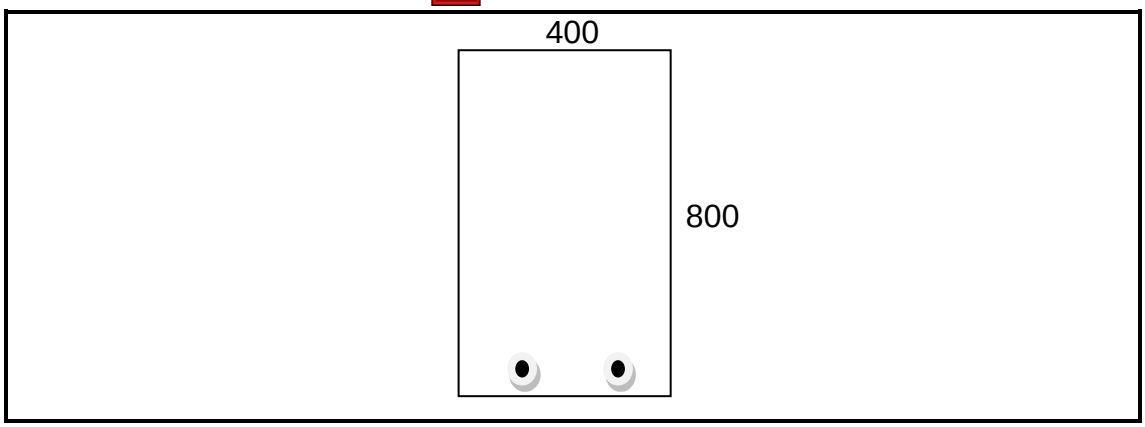

FIGURE 1

Calculate the amount of reinforcement steel required for the beam shown in FIGURE 1. The strength of the concrete is 40 MPa and the strength of the steel is 450 MPa. The beam must resist a moment of 345 kN.m and d = 187 mm. The Value of X is 187,24 (3)

1.3 Calculate the amount of steel required for a 450 mm long square column if it is subjected to an unfactored load of 3 000 kN. The strength of the concrete is 25 MPa and the strength of the steel is 300 MPa. (4)

1.4 FIGURE 2 shows a light horizontal loaded beam ABCDE.

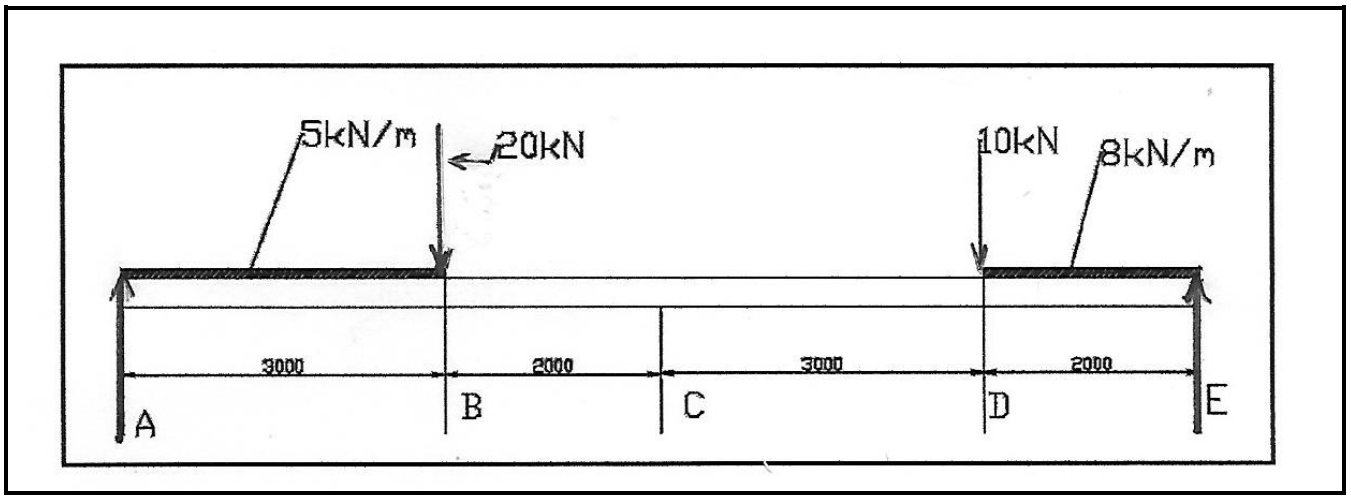

FIGURE 2

1.4.1 Calculate the magnitude of supports A and E and test the answers. (5)

1.4.2 Draw a fully labelled shear-force diagram to a suitable scale. Show all the main values on the diagram. (5)

[25]

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QUESTION 2: REINFORCED CONCRETE AND STRUCTURAL STEEL WORK

2.1 List FOUR materials commonly used in reinforced concrete structures. (4)

2.2 Explain how the reinforcement of a cantilever retaining wall is oriented.(2× 2) (4)

2.3 What are retaining walls made of? (2)

2.4 Give the rationale for using pile caps and capping beams in construction. (2)

2.5 Use the floor layout plan shown in FIGURE 3 on the ADDENDUM (attached) to give a full description of each of the following elements:

- Number of storeys
- Height of one storey
- Transverse beam size
- Transverse column spacing
- Column size
- Foundation depth
- Length of foundation
- Length of column
- Footing embedment (10)

2.6 Various options are given as possible answers to the following question. Choose the answer and write only the letter (A–D) next to the question number (2.6) in the ANSWER BOOK.

The test done for quality control of Portland cement:

A Tensile strength
B Soundness
C Setting time
D All (1)

2.7 Name TWO types of concrete tests. (2)

2.8 Briefly explain what *concrete culverts* are. (2)

2.9 Different strength concrete is used for different purposes. Name the different strengths of concrete. (3)

[30]

QUESTION 3

3.1 Choose a description from COLUMN B that matches a term in COLUMN A. Write only the letter (A–J) next to the question number (3.1.1–3.1.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1.1	Going	A	imaginary axis that indicates the linear gradient of the stairway measured from the front of the first step
3.1.2	Pitch Line	B	the length of a single step
3.1.3	Rise	C	angle of inclination of the pitch line measured from the horizontal
3.1.4	Flight	D	series of steps between two landings
3.1.5	Landing	E	horizontal distance between the start of one step to the start of the next step
3.1.6	Tread	F	radiating or angular tapering steps
3.1.7	Winder	G	bottom surface of a stair slap
3.1.8	Soffit	H	vertical distance from the top of one step to the top of the next step
3.1.9	Slope	I	vertical distance between the pitch line and the bottom of the ceiling
3.1.10	Headroom	J	the floor at the end of the stairway

(10 × 1) (10)

3.2 Define each of the following terms:

3.2.1 Yield strength

3.2.2 Dead Load

3.2.3 Paste

3.2.4 Shale

3.2.5 Settlement

(5 × 2) (10)
[20]

TOTAL: 75

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ADDENDUM

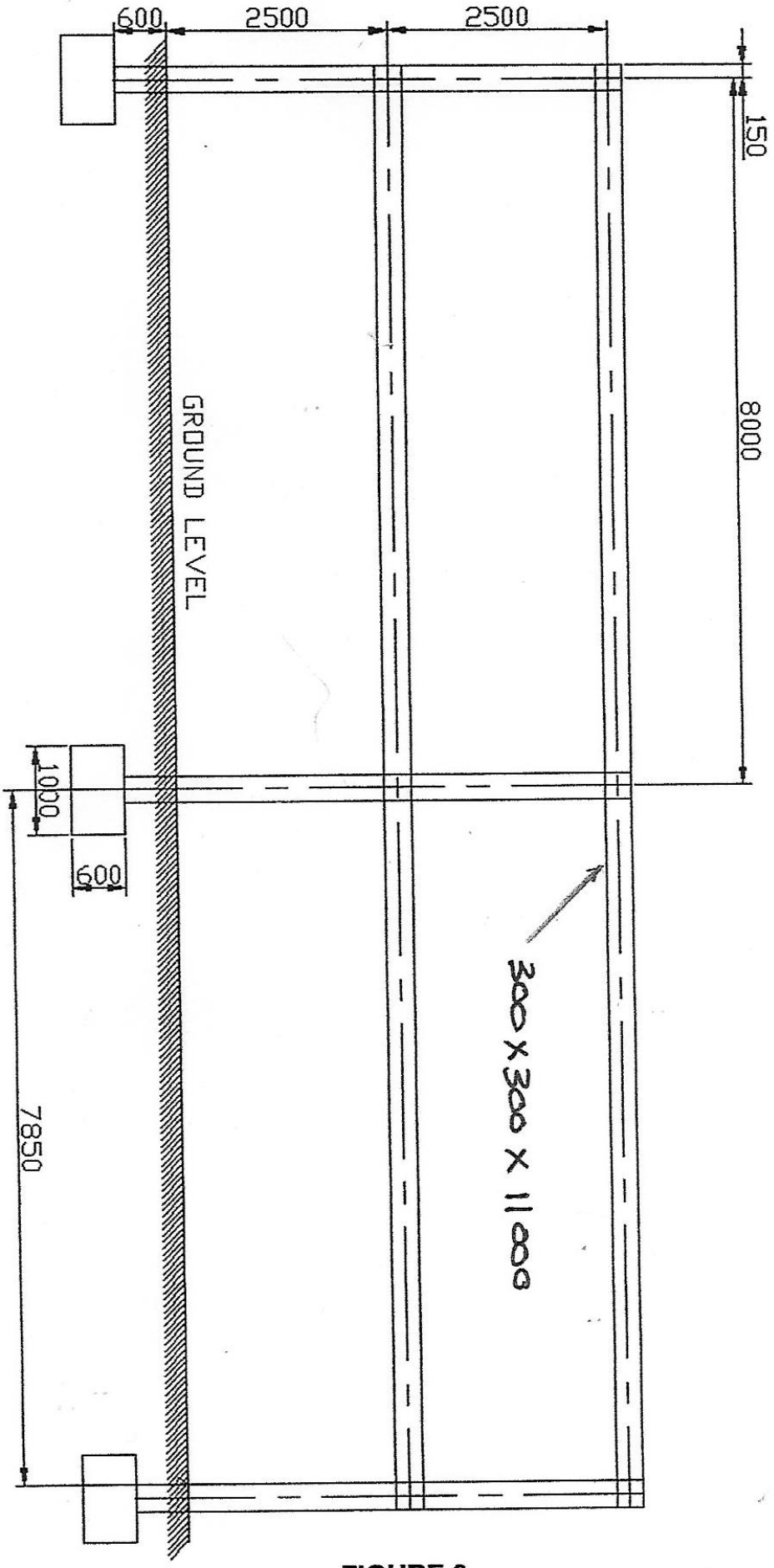

FIGURE 3

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