higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

CIVIL AND STRUCTURAL STEEL WORK DETAILING
NQF LEVEL 2

(12050652)

12 November 2024 (Y-paper)
13:00–16:00

REQUIREMENTS: A3 drawing sheet

Calculators and drawing instruments may be used.

This question paper consists of 7 pages.

051Q1N2412

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CIVIL AND STRUCTURAL STEEL WORK DETAILING
NQF LEVEL 2
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. Use only a black or blue pen.
5. Write neatly and legibly.

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QUESTION 1: INTRODUCTION TO CIVIL AND STRUCTURAL STEELWORK

1.1 There are several methods for fastening steel, each with its applications and advantages.

Explain each of the following methods:

1.1.1 Bolting

1.1.2 Welding

(2 × 2) (4)

1.2 Choose a description from COLUMN B that matches an item in COLUMN A. Write only the letter (A–J) next to the question number (1.2.1–1.2.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.2.1	Also known as H-beams, W-beams, or universal beams, these have a distinctive 'I' shape and are used for structural support	A	channel steel
1.2.2	These have a 'C' shape and are used in building frames and other structural applications	B	T-beams
1.2.3	L-shaped sections are used in various structural applications, available as equal or unequal angles	C	flat steel
1.2.4	T-shaped sections are used in construction for load-bearing purposes	D	hollow structural sections (HSS)
1.2.5	These include square, rectangular, and circular sections used in welded steel frames and columns	E	angle steel
1.2.6	Flat sections are used in various applications, including construction and manufacturing	F	I-beams
1.2.7	Circular sections are used in construction, manufacturing, and as raw material for other products	G	galvanised steel plates
1.2.8	Used in construction for building bridges, buildings, and other structures	H	round steel
1.2.9	Coated with zinc to prevent rusting, used in outdoor and industrial applications	I	corrugated steel plates
1.2.10	Used in roofing and siding, these plates have a wavy pattern for added strength	J	structural steel plates

(10 × 1) (10)

1.3 Name the ingredients in the concrete mixture. (4)

1.4 Why are steel reinforcement bars placed inside a plain concrete beam subjected to uniform load? (2)

1.5 Draw a table, and list FOUR differences between cold-formed and hot-rolled steel. (4 × 2) (8)

1.6 Which term best describes a list of reinforcing bars that make up a bill of materials? (1)

1.7 Which term best describes a round smooth bar? (1)

[30]

QUESTION 2: STRUCTURAL STEELWORK AND REINFORCED CONCRETE

2.1 Outline THREE advantages of using standardised profile lengths in structural steel. (3)

2.2 Bolts are fasteners used to hold objects together, typically consisting of a cylindrical body with a head on one end and a threaded portion on the other. They are classified based on their design and application.

List the THREE common materials used to manufacture bolts. (3)

2.3 Strength in bolts refers to their ability to withstand loads without failure.

Outline and describe THREE common modes of failure and the different ways a bolt can fail under a load. (3 × 3) (9)

2.4 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–E) next to the question number (2.4.1–2.4.2) in the ANSWER BOOK.

2.4.1 Which property of steel makes it an essential material in construction, particularly for its ability to withstand tensile stress?

A Malleability
B Ductility
C Brittleness
D Opacity
E All the above

2.4.2 Which property of steel is most advantageous in its use as a construction material?

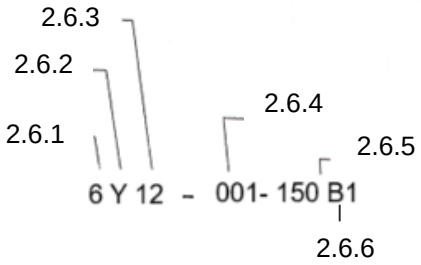
A Corrosion resistance
B High tensile strength
C Low thermal conductivity
D Transparency
E All the above

(2 × 1) (2)

2.5 Standardising profile lengths, such as six, nine, eleven, and thirteen meters, is crucial for several reasons.

Outline and explain THREE common reasons for having standard sizes in steel profile lengths. (3 × 3) (9)

2.6 Each bar in a bar-bending schedule is identified by a bar mark. Identify the labels marked 2.6.1 to 2.6.6 in the FIGURE below. Write only the answer next to the number (2.6.1–2.6.6) in the ANSWER BOOK. (6)



[30]

QUESTION 3: BOLTS IN STRUCTURAL STEELWORK

3.1 Make a freehand drawing of a bolt, and add labels to indicate the length, head size, shaft diameter, thread diameter, and thread length. (6)

3.2 State the advantages of using bolts over welding. (2)

3.3 Describe the applications of the following bolt grades: Grade 4.8 and Grade 10.9 (4)

3.4 Explain what the suffix 'S' next to a bolt's grade number indicates. (2)

3.5 Make a freehand drawing to illustrate the differences between *rectangular* and *staggered* patterns of bolt positioning. (6)

[20]

QUESTION 4: WELDING SYMBOLS AND JOINTS

4.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (4.1.1–4.1.5) in the ANSWER BOOK.

4.1.1 When the weld symbol is placed both above and below the reference line, it shows that a weld is needed on both sides.

4.1.2 The size of a fillet weld appears to the left of the weld symbol.

4.1.3 The length of a fillet weld appears to the left of the weld symbol.

4.1.4 A flag at the tangent of the reference line and arrow indicates a field weld.

4.1.5 A circle at the tangent of the arrow and the reference line means welding all around.

(5 × 1) (5)

4.2 Name the FIVE types of welding joints. (5)

[10]

TOTAL: 100

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