higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

CIVIL AND STRUCTURAL STEELWORK DETAILING

(First paper)

NQF LEVEL 4

(12050663)

1 March 2018(X-Paper)
09:00–12:00

Calculators may be used.

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

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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. Rule off across the page on completion of each question.
5. Drawings and sketches must be neat and big enough to show detail.
6. Write neatly and legibly.

NCV

QUESTION 1: GENERAL

1.1 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.1–1.9) in the ANSWER BOOK.

1.1.1 Rafters are the main beams supporting the roof.

1.1.2 False work is a temporary structure used to support a permanent structure while is not self – supporting.

1.1.3 SANS is the abbreviation for South African National Surveying

1.1.4 Compressive strength is the ability of concrete not to break when it is being pulled apart.

1.1.5 The gusset plate transfer loads between members.

1.1.6 A retaining wall reacts to forces in much the same way as a cantilever.

1.1.7 Purlin is the section used to support heavy column.

1.1.8 Steel formwork is initially less costly than timber formwork.

1.1.9 Welded joints in which pieces of metal are jointed with overlapping is called butt weld.

(9)

1.2 List the THREE forces acting on concrete by making a freehand drawing to explain these forces. (3 × 2) (6)

[15]

QUESTION 2 : REINFORCED CONCRETE DETAILING AND SPECIFICATIONS

2.1 What is the meaning of the following abbreviations?

2.1.1 EW  (1)

2.1.2 ABR  (1)

2.1.3 STGD  (1)

2.2 Name TWO materials used in reinforced concrete and why ? (4)

2.3 Detailing involves schematically describing the way in which you are going to place the steel

Briefly describe how you would orient reinforcement bars on a *slab*. (2)

2.4 Give FOUR advantages of using steel for reinforcing. (4)

2.5 Name any FOUR types of spread footing that are generally used. (4)

2.6 Name TWO types of steel reinforcement. (2)

2.7 Calculate the amount of steel required for the following beam. The strength of the concrete is 35MPa and the strength of steel is 450MPa. The beam has to resist a moment of 270KN.m. d = 570 mm, b = 300 and h = 600 (10)
[29]

QUESTION 3: STRUCTURAL STEELWORK DETAILING AND SPECIFICATIONS

3.1 Describe the purpose of a gusset connection. (2)

3.2 List FOUR simple rules for gusset fabrication. (4)

3.3 Name THREE types of truss connections. (3)

3.4 Where are portal frames used? (2)

3.5 Name TWO disadvantages of steel portal framed structures. (4)
[15]

QUESTION 4: CALCULATIONS FOR CIVIL AND STRUCTURAL STEELWORK

A simply supported beam is 16 m long. The left-hand support (L) is 2 m from the left end of the beam and the right-hand support (R) is 3 m from the end of the beam. The beam carries a uniformly distributed load of 100 N/m over a length of 10 m from the left-hand side of the beam. The beam also carries point loads of 200 N at the left end of the beam and 240 N at the right end of the beam. Ignore the weight of the beam.

4.1 Draw the beam, indicating ALL the forces acting on the beam.

Calculate the reactions L and R. (use a scale of 1 m = 1 cm for the length of the beam).

Calculate also: (8)

4.1.1 The bending moment at:

4.1.2 The left hand support (1)

4.1.3 The right-hand support (1)

4.1.4 10 m from the left end of the beam (1)

4.1.5 The maximum bending moment where the shear force is zero (2)

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4.2 Draw the shear force diagram using a scale of 1 mm = 10 N. Indicate ALL the Values on the shear force diagram. (4)

4.3 Draw a bending moment diagram using a scale of 1 mm = 10 Nm. Indicate ALL the values on the bending moment diagram. (3)
[20]

QUESTION 5: PROPERTIES OF STRUCTURAL STEELWORK AND REINFORCED CONCRETE

5.1 Cracks in concrete can occur for a number of reasons. (5)

5.2 The compressive strength of concrete obtains its full strength over a period of 28 days. Draw an enlarged sketch to indicate the strength of concrete over time and label it. (10)

5.3 Name three characteristics of concrete and the meaning of each. (6)
[21]

TOTAL: 100

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FORMULA SHEET

$F = ma$

$W = mg$

$M_B = F_A d_{AB}$

$\sum Fy = 0$

$\sum Fx = 0$

$\sum M = 0$

$\sigma = \frac{F}{A}$

$F_C = F_S$

$M = F_S \times perpendicular\ distance$

$M = F_C \times perpendicular\ distance$

$ax^2 + bx + c = 0$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$UDL = Y_{CON}\ x\ cross\ sectional\ area$

$F_C = 0.45\sigma cb(0.9x)$

$F_C = 0.45\sigma bh$

$F_S = 0.87\sigma y A_{st}$

$F_S = 0.73\sigma y A_{sc}$

$N = F_C + F_S$

$Q_B A - N - Y_S(1)(A) - Y_C(h)(A) = 0$

$A = \frac{N}{QB - YS(1) - YC(h)}$

$Q_U = \frac{UDL}{A}$

$M_r = \emptyset Z_{PI} f_y$

$M_r = \emptyset Z_e f_y$

$Self\ weight\ of\ a\ beam = m \times a$

$\lambda = \frac{KL}{r}\sqrt{\frac{fy}{\pi^2 E}}$

$C_r = \emptyset A f_y (1 + \lambda^{2.68})^{-1/1.34}$

$T_r = \emptyset Afy$

$F_{AE}\cos\theta + F_{AC} = 0$

$F_{AE} = -\frac{100}{Sin\ 30}$

$F_{AB}\sin\theta - F_{BE} = 0$

$Maximum\ compressive\ force = M_{MAX}/h$

$Maximum\ tensile\ force = F_{SMAX}/\cos\emptyset$

$F_R = F_1 + F_2 + F_3$

$0.405\sigma_C bx = 0.87\sigma_y A_{st}$

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