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education

Department:
Education
REPUBLIC OF SOUTH AFRICA

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APRIL 2010

NATIONAL CERTIFICATE

BUILDING AND STRUCTURAL CONSTRUCTION N5

(8060015)

24 March (X-Paper)
09:00 – 13:00

REQUIREMENTS: A2 drawing paper.
Standard hot-rolled structural steel section
tables (BOE 8/2).

This question paper consists of 6 pages and 1 formula sheet.

**DEPARTMENT OF EDUCATION
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
BUILDING AND STRUCTURAL CONSTRUCTION N5
TIME: 4 HOURS
MARKS: 100**

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
 2. Read ALL the questions carefully.
 3. Number the answers correctly according to the numbering system used in this question paper.
 4. Drawings MUST be done according to the latest building regulations.
 5. Use BOTH SIDES of the drawing paper, if needed.
 6. Write neatly and legibly.
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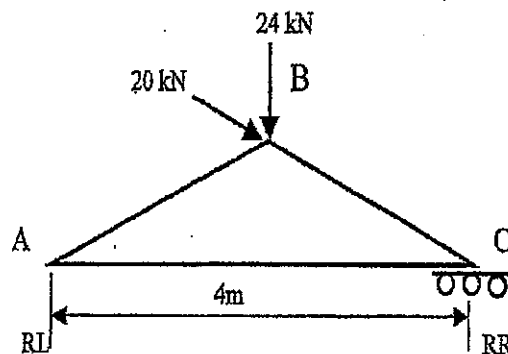
QUESTION 1: FRAMEWORK**FIGURE 1**

FIGURE 1 shows a loaded roof truss, with TWO forces at the apex and a pitch of 30° at both sides. The roof truss is supported on a hinge at RL and rests by means of rollers at RR.

- 1.1 Calculate the magnitude and direction of the reactions, of the roof truss as shown.

(8)

PTO

- 1.2 Calculate the forces in each member, and distinguish between tension and compression forces in the members.

Tabulate the results. NO marks will be allocated for a graphical solution.

(6)
[14]

QUESTION 2: SECTION MODULES

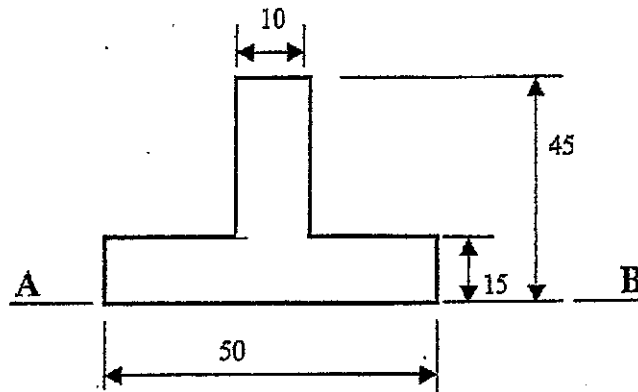


FIGURE 2

FIGURE 2 shows a cross section through TWO steel sections welded together as ONE. The dimensions are given in mm.

Calculate the following:

- 2.1 The distance of the neutral axis from A-B (4)
- 2.2 The moment of inertia of the profile about the neutral axis (5)
- 2.3 The profile modules (z) about the neutral axis (4)

[13]

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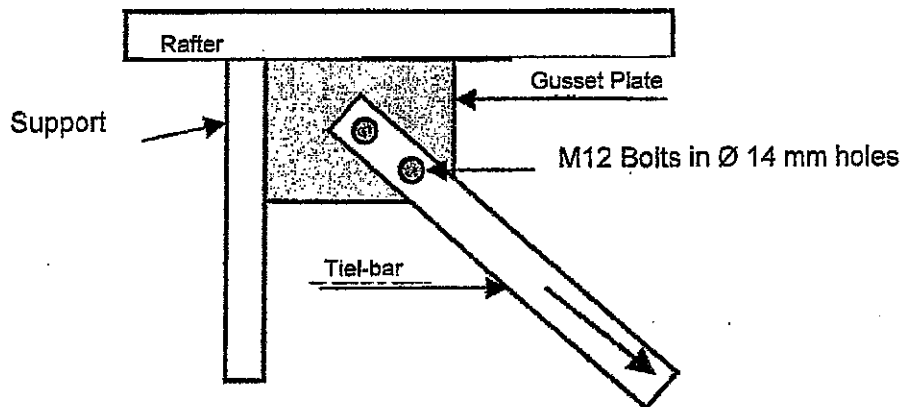
QUESTION 3: BOLT CONNECTIONS**FIGURE 3**

FIGURE 3 shows a bolted connection between a tie-bar and a gusset plate with TWO M12, grade 4,6 bolts.

Calculate the following:

- 3.1 Resistance force of the bolts to shearing (4)
- 3.2 Resistance force of the tie-bar to tearing (4)
- 3.3 Resistance force of the bolts to crushing (4)
- 3.4 Maximum force this connection can withstand safely (1)

Use the following specifications:

Bolts	M12 (Ø12 mm)
Tie	50 × 8 mm
Gusset	8 mm
Holes in the tie-bar and gusset	Ø 14 mm
Maximum shear stress of bolts	100 MPa
Maximum shear stress of tie	155 MPa
Maximum compressive stress of the bolts	240 MPa

[13]

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QUESTION 4

Draw to scale 1:5, a vertical longitudinal section, through THREE steps, of a steel staircase with wooden treads 305 × 20 mm and no risers. The drawing MUST SHOW the steel stringer and ALL construction details.

Use the following specifications:

Going	280 mm
Rise	175 mm
Tread	305 mm

The welding symbols MUST BE SHOWN.

[12]

QUESTION 5

Explain by means of drawings, the construction differences between a transverse spanning and a longitudinal spanning reinforced concrete staircase. (6 + 6)

[12]

QUESTION 6

A reinforced concrete pad foundation supports a circular reinforced concrete column. Draw to scale 1:20 the following to show the positioning of the reinforcement and the other constructional details. Use third-angle orthographic projection.

6.1 A top view of the reinforced concrete pad foundation with the reinforced concrete column, in the centre of the foundation.

(8)

6.2 A vertical section through the reinforced concrete pad foundation and the reinforced concrete column. SHOW approximately 400 mm of the concrete column.

(10)

Use the following specifications:

PAD FOUNDATION

Size	: 2 000 × 2 000 × 500 mm
Reinforcing	: Ø 15 mm bars at 150 mm centres in both directions

Blinding concrete	: 75 mm
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COLUMN:

Diameter	: 600 mm
Reinforcing	: 6/Ø 20 mm longitudinal bars and Ø 6 mm helical binders at 150 mm centres

[18]

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QUESTION 7

Draw neat isometrical drawings to identify the following bolt connections:

- | | | |
|-----|---|------------|
| 7.1 | A lap joint (double riveted parallel rivets) | (3) |
| 7.2 | A butt joint with double-gusset plate (with double row of rivets) | (3) |
| 7.3 | Gusset plate connected to a tie-bar (using TWO rivets in a line) | (3) |
| | | [9] |

QUESTION 8

Explain, by means of a neat drawing, the method of construction, to fix glazing floor tiles to a reinforced concrete floor.

NOTE: Label your drawing.

[9]

TOTAL: 100

BUILDING AND STRUCTURAL CONSTRUCTION N5**FORMULA SHEET**

Any applicable formula may also be used.

$$BM = \frac{w\ell}{4}$$

$$BM = \frac{w\ell^2}{8}$$

$$n = 5d$$

$$n = 5.5d$$

$$h = 9d$$

$$h = 11d$$

$$F = f.a$$

$$f = f_s \frac{\pi D^2 n}{4}$$

$$F = f_t (W - n.d) t$$

$$F = f_b D.t.n$$

$$F = \frac{\pi(\phi - 0.9382 \phi)^2 n}{4}$$

$$I = \left[\frac{BD^3}{12} \right] + [2 \text{ area} . y^2]$$

$$\frac{M}{I} = \frac{f}{y} = \frac{E}{R}$$

$$M = fZ$$

$$Z = \frac{I_{NA}}{y}$$

$$M = f \frac{I}{y}$$

$$M = \frac{fbd^2}{6}$$