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education

Department:
Education
REPUBLIC OF SOUTH AFRICA

**T160(E)(M26)T
APRIL 2010**

NATIONAL CERTIFICATE

BUILDING AND STRUCTURAL CONSTRUCTION N6

(8060026)

**26 March (X-Paper)
09:00 – 13:00**

**REQUIREMENTS: Answer book/s
Tables BOE 8/2**

Candidates may use personal notes and text books.

Calculators may be used.

OPEN-BOOK EXAMINATION

This question paper consists of 4 pages, 2 schedules and 1 diagram sheet.

**DEPARTMENT OF EDUCATION
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BUILDING AND STRUCTURAL CONSTRUCTION N6
TIME: 4 HOURS
MARKS: 100**

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
 2. ALL the work must be according to the latest building regulations.
 3. ALL the calculations must be shown.
 4. Show ALL the code references.
 5. Use the attached SCHEDULES A and B to simplify your calculations.
 6. 100 marks: 100%
 7. Write neatly and legibly.
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QUESTION 1

A steel pipe column must support an axial load of 42,5 kN. The pipe column has a length of 2,800 m and is effectively held in position. The pipe column is effectively held in position at both ends and restrained against rotation at one end only. Make the necessary calculations and select the most suitable column from the given table.

Size	M	ϕ	t	A	I	Z	I
mm	kg/m	mm	mm	10^3mm^2	10^6mm^4	10^3mm^3	mm
76	4,01	76,5	2,2	0,5108	0,3490	9,1716	26,1
89	6,39	89,3	3,0	0,8096	0,7476	16,8197	30,4
101	8,47	101,6	3,5	1,0787	1,2992	25,575	34,7

[13]

PTO

QUESTION 2

A simply supported beam, 533 x 210 x 109 kg/m (PF), is required to support a point load of 460 kN at mid-span. Determine the maximum effective span of the beam if the self weight is taken into consideration and the maximum bending stress = 190 MPa.

[13]**QUESTION 3**

A simply supported reinforced concrete slab has an effective span of 5,200 mm and supports a live load of 110 kNm². Determine the minimum effective depth of the slab if grade 25 concrete is used.

Ignore the self weight of the beam.

[8]**QUESTION 4**

FIGURE 1, DIAGRAM SHEET 1 (attached), shows a connection of a steel roof truss with the direction of the forces shown in each member. Parts marked 'A' and 'B' are single discontinuous angle iron profiles, fixed both sides to a 12 mm gusset plate.

- 4.1 The part marked 'A' is fixed to the gusset by means of grade 4.6, M 22 bolts. Determine the number of M 22 bolts required to fix the part marked 'A' to the gussets safely. (The thread of the bolts is in the shearing plane). (7)
- 4.2 The part marked 'B' is fixed to the gusset by means of a fillet welding joint with a leg size of 12 mm. Calculate the minimum effective length of welding joint. (7)
- 4.3 Select a suitable equal-leg angle for the parts marked:
 - 4.3.1 'A'; of length 2,100 mm (8)
 - 4.3.2 'B' (8)

Use grade 43 steel.

[30]**QUESTION 5**

An axially loaded reinforced concrete column with a diameter of 725 mm has to safely support an ultimate load of 5 215 kN. Grade 30 concrete with high-yield longitudinal reinforcing bars and mild steel links are used.

- 5.1 Calculate the minimum cross sectional area of the longitudinal reinforcement and select suitable bars. (10)
- 5.2 Calculate the pitch and diameter of the links required. (5)
- 5.3 Draw, to any suitable scale, a cross-sectional view of the column to show the positioning of the reinforcement in the column. (5)

[20]

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QUESTION 6

A simply supported L-beam has an effective span of 6,250 m. The total dead load is 30 kN/m^2 and the imposed load is 12 kN/m^2 . Grade 30 concrete with high-yield steel reinforcement is used. Calculate suitable tension reinforcement for the beam.

(HINT: Assume that the neutral axis would be within the flange of the flanged beam).

[16]

TOTAL: 100

DIAGRAM SHEET 1

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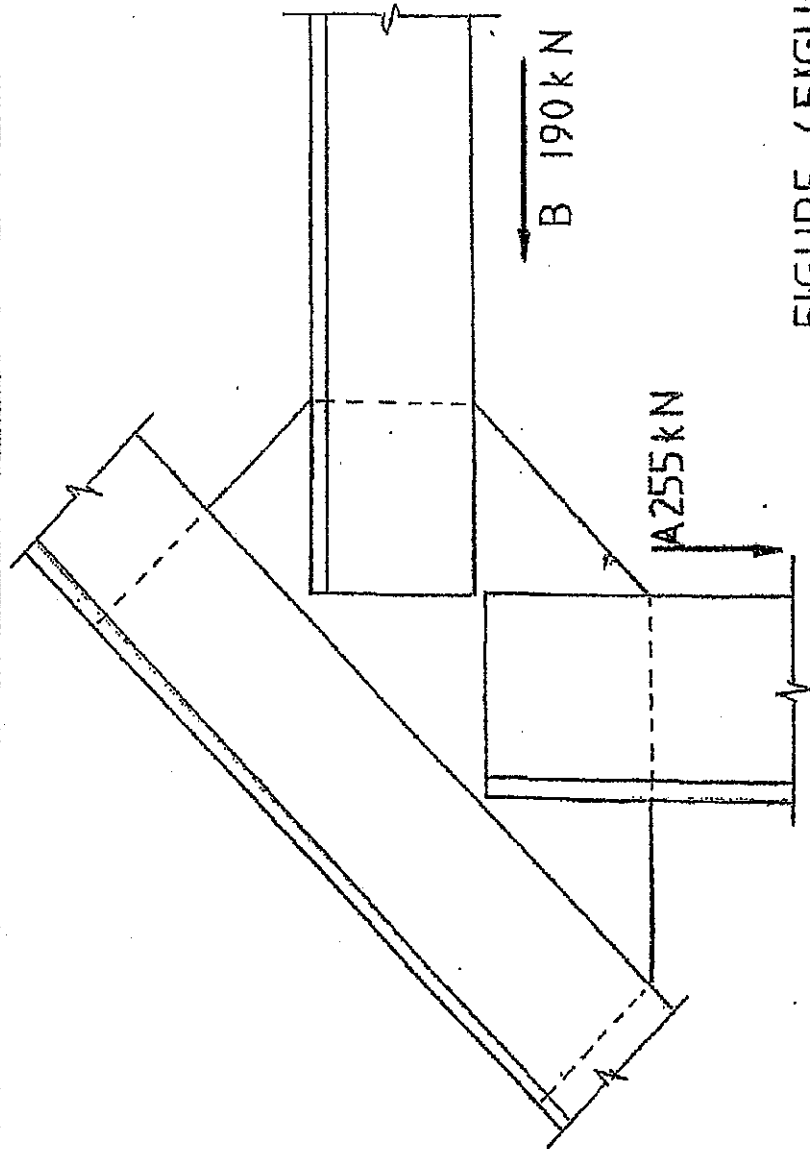


FIGURE / FIGUUR 1

Typical main reinforcement (floor slabs)

SCHEDULE B

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ISOMETRIC BLACK HEXAGON BOLTS AND NUTS

Nominal size and thread diameter	DIMENSIONS IN MILLIMETRES								
	Pitch of thread coarse pitch series	Maximum width of head and nut		Maximum height of head		Maximum thickness of nut		Tensile stress area in mm ²	Minimum distance between centres
		Across flats	Across corners	Black	Faced on underside	Black	Faced one side		
M6	1	10.00	11.5	4.375	4.25	5.375	5	20.1	15
M8	1,25	13.00	15.0	5.875	5.74	6.875	6.5	36.6	20
M10	1,5	17.00	19.6	7.45	7.29	8.45	8	58.0	25
M12	1,75	19.00	21.9	8.45	8.29	10.45	10	84.3	30
M16	2	24.00	27.7	10.45	10.29	13.55	13	157	40
M20	2,5	30.00	34.6	13.90	13.35	16.55	16	245	50
(M22)	2,5	32.00	36.9	14.90	14.35	18.55	18	303	55
M24	3	35.00	41.6	15.90	15.35	19.65	19	353	60
(M27)	3	41.00	47.3	17.90	17.35	22.65	22	459	67.5
M30	3,5	46.00	53.1	20.05	19.42	24.65	24	561	75
(M33)	3,5	50.00	57.7	22.05	21.42	26.65	26	694	82.5
M36	4	55.00	63.5	24.05	23.42	29.65	29	817	90
(M39)	4	60.00	69.3	26.05	25.42	31.80	31	976	97.5
M42	4,5	65.00	75.1	27.05	26.42	34.80	34	1120	105
(M45)	4,5	70.00	80.8	29.05	28.42	36.80	36	1300	112.5
M48	5,0	75.00	86.6	31.05	30.42	38.80	38	1470	120
(M52)	5,0	80.00	92.4	34.25	33.50	42.80	42	1760	130
M56	5,5	85.00	98.1	36.25	35.50	45.80	45	2030	140