higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE:
MULTIDISCIPLINARY DRAWING OFFICE PRACTICE

STRUCTURAL STEEL DETAILING

(8090225)

19 November 2019 (X-Paper)
09:00–13:00

CLOSED-BOOK EXAMINATION

REQUIREMENTS: **A3 drawing sheets**
Hot-rolled steel book

Computer software may be used.

This question paper consists of 5 pages, 2 diagram sheets and 1 information sheet.

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STRUCTURAL STEEL DETAILING
TIME: 4 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 both sides of the DRAWING SHEETS.
5. Draw a 15 mm border around the DRAWING SHEETS on both sides.
6. Cleary show the QUESTION NUMBERS.
7. ALL drawing work must comply with the SANS 10111.
8. A balanced layout is very important and candidates will be penalised for poor planning.
9. Work neatly.

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QUESTION 1: INTRODUCTION

1.1 Define each of the following terms:

1.1.1 Back mark

1.1.2 End distance

(2 × 1) (2)

1.2 Differentiate between *black bolts* and *HSFG bolts*. (2 + 2) (4)

1.3 Draw a welding symbol which gives the following information:

- 6 mm continuous fillet weld on arrow side
- 6 mm stich weld on other side 100 mm long at 250 mm pitch
- Welding done on site (4)

[10]

QUESTION 2: BEAMS

FIGURE 1, DIAGRAM SHEET 1 (attached), shows a view of a steel structure.

Draw, to scale 1:10, fully detailed drawings of the beams marked B1 and B2 and supply enough information for the manufacturing of the beams in a workshop. ALL plates are 10 mm thick and ALL bolts are M20.

Show the following information:

2.1 Column centres (4)

2.2 Lengths and sizes of the beams over the end plates (6)

2.3 Dimensions of the beams over the end plates (6)

2.4 Dimensions of the drilling of the bolt holes (5)

2.5 View with dimensions of end plates (5)

2.6 Item marks, number of beams required and diameter of bolt holes (4)

Information NOT given is left to your discretion. **[30]**

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QUESTION 3: COLUMNS

FIGURE 1, DIAGRAM SHEET 1 (attached), shows a view of a steel structure.

Draw, to scale 1:10, fully detailed drawings of the columns marked C1 and C2 and supply enough information for the manufacturing of the columns in a workshop. ALL plates are 10 mm thick and ALL bolts are M20.

Show the following information:

3.1 Length and sizes of the columns (5)

3.2 Dimensions of the columns over the cap and base plates (5)

3.3 Dimensions of the drilling of the bolt holes (5)

3.4 View with dimensions of cap and base plates (5)

Information NOT given is left to your discretion. **[20]**

QUESTION 4: LATTICE GIRDERS

FIGURE 2, DIAGRAM SHEET 2 (attached), shows a line diagram of a typical bolted latticed girder.

Draw, to scale 1:5, typical details of each of the following:

4.1 Detail A (5)

4.2 Detail B (5)

4.3 Detail C (5)

Specifications:

ALL external members:	80 × 80 × 6 hot-rolled steel angle profile
ALL internal members:	60 × 60 × 6 hot-rolled steel angle profile
ALL gusset plates:	10 mm thick
Bolt-hole edge distances:	Minimum of 40 mm

ALL bolt holes are drilled on the centre line of the angles and ALL bolts are M20. Do NOT insert any dimensions. Information NOT given is left to your discretion. **[15]**

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QUESTION 5: TRUSSES

FIGURE 3, DIAGRAM SHEET 2 (attached), shows a line diagram of a typical bolted latticed girder.

Draw, to scale 1:5, typical details of the following:

5.1 Detail A (5)

5.2 Detail B (5)

5.3 Detail C (5)

5.4 Detail D (5)

Specifications:

Outside booms:	100 × 100 × 10 hot-rolled steel angle profile
ALL internal members:	70 × 70 × 6 hot-rolled steel angle profile
ALL gusset plates:	10 mm thick
Bolt-hole edge distances:	Minimum of 30 mm

ALL bolt holes are drilled on the centre line of the angles and ALL bolts are M16. Do NOT insert any dimensions. Information NOT given is left to your discretion. **[20]**

QUESTION 6: MATERIALS DELIVERY SCHEDULE

Make a typical material list of 170 × 80 mm that can be used to itemise the materials of a detail drawing. Insert suitable headings. **[5]**

TOTAL: 100

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DIAGRAM SHEET 1

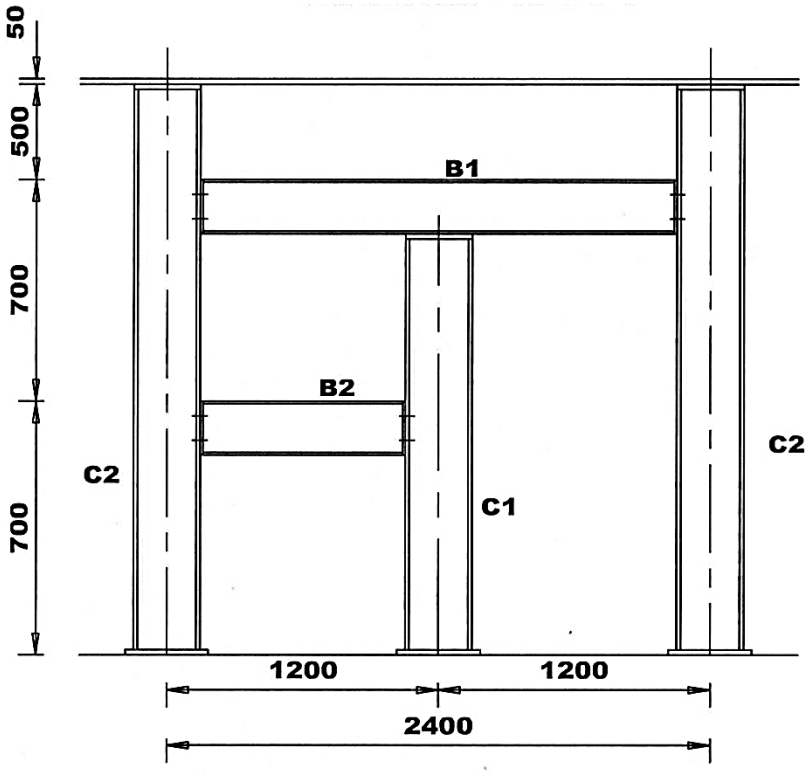


FIGURE 1

BEAMS	**B1 - UB 305 X 102 X 25 kg/m**
	B2 - UB 254 X 146 x 31 kg/m
COLUMNS	**C1 - UC 203 X 203 X 52 kg/m**
	C2 - UC 254 X 254 X 73 kg/m

End plates 10mm with 4 x M20 bolts

Base plates 20mm with 2 x M20 bolts

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DIAGRAM SHEET 2

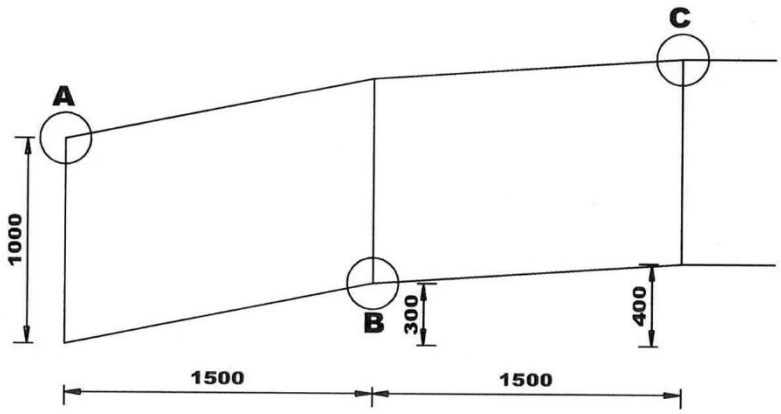


FIGURE 2

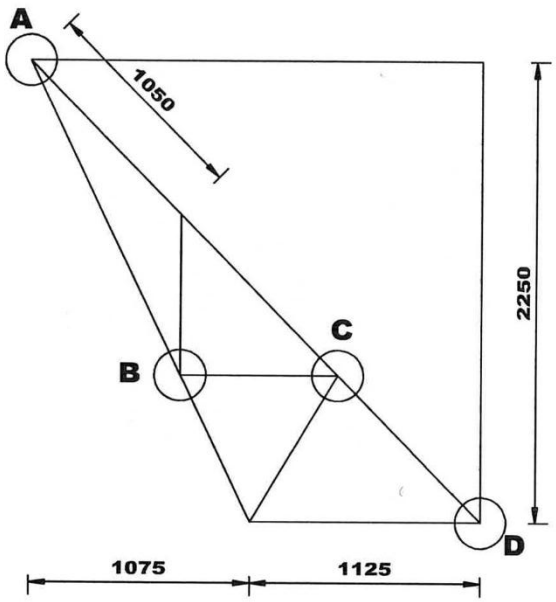
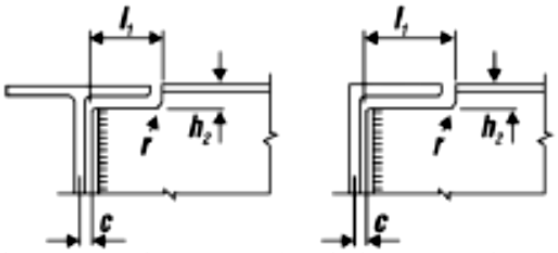


FIGURE 3

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(8090225)

INFORMATION SHEET



Dimension c is to face of end plate or angle cleat.
r = 10mm minimum
Dimensions are in mm.

	Section	c	Notch			Section	c	Notch	
			l_1	h_1				l_1	h_1
I - Sections (parallel flange)	100 x 55 x 8	4	33	15	I - Sections (parallel flange)	533 x 210 x 82	4	33	15
	120 x 64 x 19	4	37	15		93	4	37	15
	140 x 73 x 13	4	42	20		101	4	42	20
	160 x 82 x 16	5	47	20		109	5	47	20
	180 x 91 x 19	5	51	20		122	5	51	20
	200 x 100 x 22	5	56	25		610 x 229 x 101	5	56	25
	203 x 133 x 25	5	74	20		113	5	74	20
	30	5	74	20		125	5	74	20
	254 x 146 x 31	5	81	20		140	5	81	20
	37	5	81	25	I - Sections (taper flange)	127 x 76 x 13	5	81	25
	43	6	81	25		152 x 89 x 17	6	81	25
	305 x 102 x 25	5	57	25		178 x 102 x 22	5	57	25
	29	5	57	20		203 x 102 x 25	5	57	20
	33	5	57	20		52	5	57	20
	41	5	91	25		254 x 152 x 59	5	91	25
	46	5	91	25		305 x 152 x 66	5	91	25
	54	6	91	25	Channels	100 x 50 x 11	6	91	25
	356 x 171 x 45	5	94	25		120 x 55 x 13	5	94	25
	51	5	94	25		140 x 60 x 16	5	94	25
	57	6	94	30		160x 65 x 19	6	94	30
	67	7	94	30		180 x 70 x 22	7	94	30
	104 x 140 x 39	5	78	25		200 x 75 x 25	5	78	25
	46	5	78	25		220 x 80 x 29	5	78	25
	54	6	97	25		240 x 85 x 32	6	97	25
	60	6	97	30		260 x 90 x 38	6	97	30
	67	6	97	30		280 x 95 x 42	6	97	30
	457 x 191 x 67	6	103	25		300 x 100 x 46	6	103	25
	75	7	103	30		76 x 38 x 7	7	103	30
	82	7	103	30		127 x 64 x 15	7	103	30
	90	7	103	30		152 x 75 x 18	7	103	30
	98	8	103	35		178 x 54 x 15	8	103	35
H - Sections	152 x 152 x 23	5	84	20	H - Sections	381 x 102 x 55	5	84	20
	30	5	84	20		254 x 254 x 107	5	84	20
	37	6	84	20		132	6	84	20
	203 x 203 x 45	6	111	25		167	6	111	25
	52	6	111	25		305 x 305 x 97	6	111	25
	60	7	111	30		118	7	111	30
	72	7	111	30		137	7	111	30
	86	8	111	35		158	8	111	35
	254 x 254 x 73	6	138	30		198	6	138	30
	89	7	138	35		240	7	138	35

Dimensions of beam notches

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