



Province of the  
**EASTERN CAPE**  
EDUCATION

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**SEPTEMBER 2010**

**CIVIL TECHNOLOGY  
MEMORANDUM**

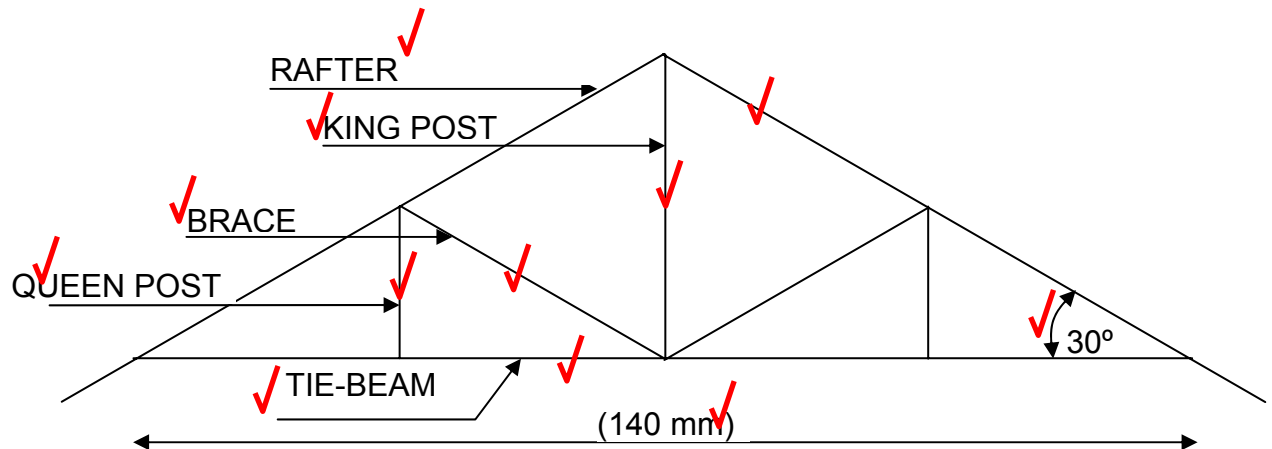
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This memorandum paper consists of 11 pages.

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## QUESTION 1

- 1.1 1.1.1 Scale 1:50 a line diagram – South African roof truss – span width of 7mr. Pitch of  $30^\circ$  – overhang of 500 mm. Name all the parts. (12)



- 1.1.2 TWO methods to fix roof truss parts to each other.

- Connector plates
- Nail with bolt and nuts

(2)

- 1.1.3 Quantity list – approximate lengths

(10)

PART	LENGTH	WIDTH	THICKNESS	NUMBER	TOTAL
Rafter	4 600 + 50	114	38	2	9,3 m
King post	2 010 + 50	114	38	1	2,06 m
Brace	2 000 + 50	114	38	2	4,1 m
Queen post	1 050 + 50	114	38	2	2,2 m
Tie-beam	7 000 + 50	114	38	1	7,05 m
TOTAL					24,71 m

- 1.2 Type of roof covering (1)

- 1.3 Difference: Stub mortise and tenon joint – Depth of tenon =  $\pm \frac{2}{3}$  width of stile

Through mortise and tenon joint – Tenon passes through stile (2)

- 1.4 Board products in FIGURES 1.4.A to 1.4.C:

- 1.4.1 A – Ply wood  
B – Block board  
C – Laminated board

(3)

1.4.2 *Any FIVE advantages of board 1.4.A – Plywood*

- More consistent in strength
- High dimensional stability
- Nail close to edge
- Available in large sheets
- Economical
- Does not warp
- Repetitive patterns
- Curves/bends easily
- Dries rapidly
- Durable

(5)

## 1.4.3 A – Plywood

B – Block board

(2)

## 1.4.4 Veneer

(1)

1.4.5 *Any TWO cutting methods*

- Peeling
- Sawing
- Flat slicing
- Quarter slicing
- Half round slicing
- Back slicing
- Half quarter slicing

(2)

**[40]**

**QUESTION 2**

2.1 *Any TWO responsibilities of the employer*

- Machines equipped with guards
- Issue workers with safety equipment
- Workers are trained to use machines safely
- Workplace free of harmful gases, etc. (2)

2.2 *Ordinance on construction work*

Protects (1) safety, (2) health and (3) general welfare of (4) workers and operators. (4)

2.3 *Any FOUR safety measures – safe storage of materials.*

- Stacked on strong floors
- Not higher than 3x the width of stack
- Stacks must be interlocked/strapped
- Materials not protruding
- Not obstruct fire fighting equipment, light or ventilation
- Flammable materials/liquids stored in special containers
- Not obstruct routes
- Gases in special containers (4)

2.4 (1) When tools are blunt (2) more pressure must be placed – cause injury (2)

2.5 *Identify FOUR safety measures – scaffolds.*

2.5.1 It should not be moved while workers are still on the scaffold

~~2.5.2 The scaffold may only be moved when the workers are secured with harnesses;~~

2.5.3 Scaffolds must be constructed on a level surface;

~~2.5.4 The tubes must be lengthened when scaffolds are constructed on a slant, to ensure a horizontal platform;~~

~~2.5.5 High scaffolds must be anchored to the ground with stay wires;~~

~~2.5.6 Scaffolds must not be constructed higher than six storeys;~~

2.5.7 A guard rail must be added to the scaffold;

2.5.8 Scaffolds must be constructed upright. (4)

2.6 A – Planks/Board/Steel panels

B – Raking shore

C – Sole plate (3)

2.7 Name ONE use of each tool:

2.7.1 Sliding bevel; – Draw angle lines/Test angles/Guide when drilling angled holes

2.7.2 Marking gauge; – Draw lines parallel to edge of wood

2.7.3 Trying plane; – Straight planning of long edges/Remove large amounts of wood

2.7.4 Ripsaw; – Saw with grain of wood/Cut wood to width

2.7.5 Mallet. – Hammer chisels/Hammering wood parts together (5)

2.8 Any THREE safety measures – crosscutting with circular saw

- (1) Mitre gauge removed as far (2) as possible from the fence
- (1) When using a guide block (2) front end must not be next to the blade
- (1) For angle cutting, (2) cutting angle away from blade (6)

2.9 Crosscutting (1)

2.10 Yes – plane direction is with the grain of the wood (2)

2.11 Answer the following questions with regard to the wood seasoning method in FIGURE 2.11.

2.11.1 Kiln seasoning (1)

2.11.2 Any TWO advantages

- (1) Any species/thickness (2) be dried to any moisture content
- (1) Better control over (2) seasoning methods
- (1) Development of tensions (2) detect/controlled early (4)

2.11.3 Any TWO reasons for seasoning of wood.

- Not swell or shrink to be in equilibrium with atmospheric conditions
- Free of stress
- Not losing shape
- Not attacked by fungi
- Able to treat with preservatives
- Prevent wood beetles
- Stronger than wet timber
- Adhesives/paint better
- Lighter

(2)  
[40]

**QUESTION 3**

- 3.1 (1) M – mechanical graded (2) 6 – Grade of (3) flexibility/MPa (3)
- 3.2 222 x 116 x 73 (220 x 110 x 75) (3)
- 3.3 3.3.1 – Dead end
- 3.3.2 – Tooothing (2)
- 3.4 *Any THREE factors determining maximum water temperature*
- Extent of exposure to sun
  - Time of year
  - Amount of cloud coverage
  - Amount of day light
  - - Time of day (3)
- 3.5 3.5.1...copper pipes 3.5.2...non-corrosion  
 3.5.3...fibre glass 3.5.4...isolation material  
 3.5.5...polystyrene 3.5.6...copper pipes  
 3.5.7...black 3.5.8...tempered  
 3.5.9...intensifies 3.5.10..impurities (10)
- 3.6 *Any FOUR properties of PVC pipes*
- Resistance to chemicals
  - Flexible
  - Easily damage by sharp objects
  - Not for hot water
  - Long lengths
  - Cheaper
  - Less labour for installation
  - Easy to join (4)
- 3.7 French drain – (1) Trench with (2) certain width and depth (3) filled with stones and (4) covered with layer of soil (4)
- 3.8 *Advantage of wind power generating above coal power generating.*  
 (1) Wind – no pollution (2) Coal – Pollution/Labour intensive (2)
- 3.9 (1) Isolation material does not conduct electricity (2) Prevent loss of electricity and for safety (2)
- 3.10 Concrete mix (1) Cement (2) Stone (3) Sand (4) Water. (4)
- 3.11 (1) Air bubbles out (2) Spread concrete/stone (2)
- 3.12 *Any TWO methods to compact concrete*
- Hand compacting/Beam
  - Vibration/Immersion (1)

**[40]**

## QUESTION 4

- 4.1 FIGURE 4.1 shows a symmetrical body on axis XY.  
Determine the centre of gravity of the body on the centre line from X.  
(The table on Sheet A can be used for the calculations) (11)

$$\begin{aligned} 1: 8 \times 4 &= 32 \\ 2: 4 \times 4 &= 16 \\ 3: \frac{1}{2} \times 6 &= 12 \\ \text{Total:} &= 60 \end{aligned}$$

$$\begin{aligned} \text{Moments around X} \\ (60 \times X) &= (32 \times 2) + (16 \times 6) + (12 \times 10) \\ 60X &= 64 + 96 + 120 \\ &= 280 \div 60 \\ &= 4,67 \text{ from X} \end{aligned}$$

- 4.2 FIGURE 4.2 on Sheet A shows a space diagram of a roof truss. (9)

- 4.3 FIGURE 4.3 shows a beam with distributed and pointed loads.  
Determine the reaction forces of supports A and B.

$$\begin{aligned} \text{Around A} \\ \text{L.O.M} &= \text{R.O.M} \\ (B \times 6) + (30 \times 2) &= (30 \times 2) + (50 \times 6) \\ B \times 6 + 60 &= 60 + 300 \\ B \times 6 &= 360 - 60 \\ B &= \frac{300}{6} \\ &= 50 \text{ N} \end{aligned}$$

$$\begin{aligned} \text{Around B} \\ \text{R.O.M} &= \text{L.O.M} \\ (A \times 6) &= (30 \times 4) + (40 \times 6) + (30 \times 8) \\ A \times 6 &= 120 + 240 + 240 \\ B &= \frac{600}{6} \\ &= 100 \text{ N} \end{aligned}$$

- 4.4 FIGURE 4.4 on Sheet B:

- 4.4.1 The shear forces of points A to D, and (4)

- 4.4.2 The shear forces of points A to D, and (4)

- 4.5 'n Bar with a length of 2 meter and a radius of 3 mm, lengthens with 0,04mm when it is subjected to a tensile force of 500 N.

$$\begin{aligned} 4.5.1 \quad A &= r^2 \times \pi = (0,003)^2 \times \pi = 0,000 \, 028 \, 274 \, 333 \, \text{m}^2 \\ \sigma &= \frac{F}{A} = \frac{500 \, \text{N}}{0,000 \, 028 \, 274 \, 333 \, \text{m}^2} = 17 \, 683 \, 882,57 \, \text{Pa} \end{aligned} \quad (5)$$

$$4.5.2 \quad \epsilon = \frac{\Delta L}{L_0} = \frac{0,000 \, 04}{2} = 0,000 \, 02 \quad (3)$$

$$4.5.3 \quad E = \frac{\sigma}{\epsilon} = \frac{17 \, 683 \, 882,57 \, \text{Pa}}{0,000 \, 02} = 8,841 \, 941 \, \text{Pa} \quad (4)$$

[40]

**QUESTION 5**

5.1 Answer the following questions with regard to the structure in FIGURE 5.1:

- |       |                          |                    |                |      |
|-------|--------------------------|--------------------|----------------|------|
| 5.1.1 | A – Purlin               | B – Beam filling   | C – DPC        |      |
|       | D – Air brick/drip joint | E – Tie beam       | F – Wall plate |      |
|       | G – Cavity               | H – Wall tie       | I – Lintel     |      |
|       | J – Inner wall/brickwork | K – Ground filling |                | (11) |

5.1.2 Prevent water to enter to inner wall (1)

5.1.3 Draining of damp in cavity (1)


5.1.4 38 x 38 mm (2)

5.1.5 114 x 38 (2)

5.1.6 Wood (1)

5.1.7 Concrete (1)

5.2 FIGURE 5.2 on Sheet C shows an uncompleted floor plan with drainage of a house.

The openings indicated by the  symbol, does NOT indicate the correct drawing practice symbols. Complete the floor and drainage plan on sheet C by drawing in the following symbols:

5.2.1 Window at opening W1; (4)

5.2.2 Outer door at opening D1; (3)

5.2.3 Inner door at opening D2; (2)

5.2.4 Concertina door at opening D3; (2)

5.2.5 Sliding door at opening D4; (4)

5.2.6 All drainage access openings which are required by regulations; (4)

5.2.7 Vent pipe; (1)

5.2.8 Gully. (1)

**[40]**

**TOTAL: 200**

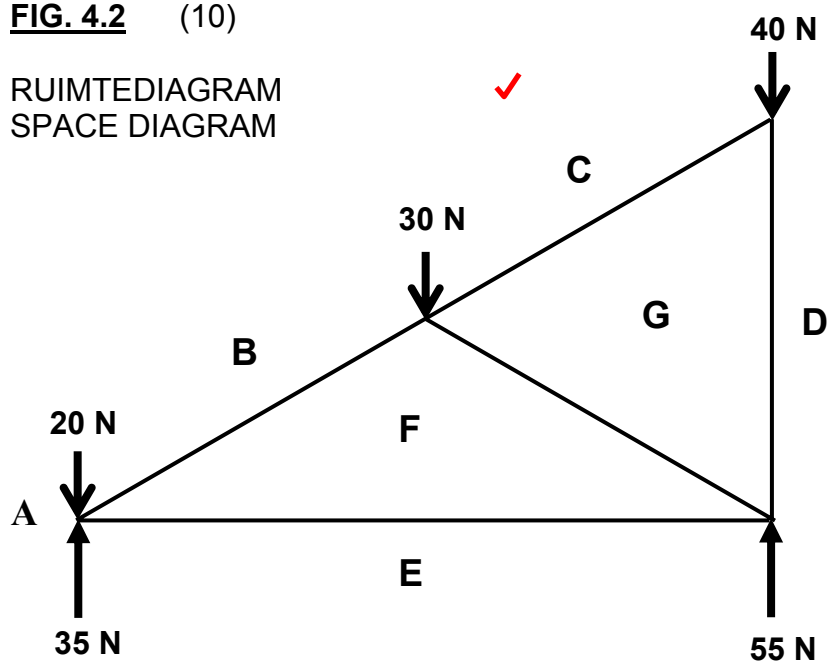


<b>ANTWOORDBLAD</b> <b>ANSWER SHEET</b>	<b>A</b>	<b>SIVIELE TEGNOLOGIE</b> <b>CIVIL TECHNOLOGY</b>	<b>NAAM:</b> _____ <b>NAME:</b> _____

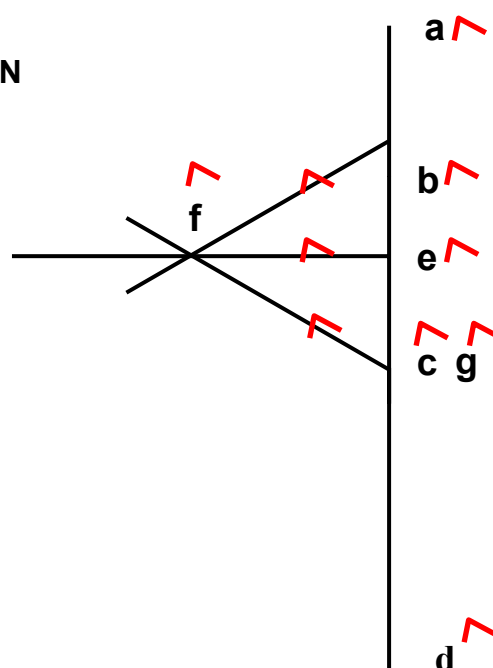
**Vr. / Q. 4.1** (11)

Vorm / Shape	Area	X	m X
1	$L \times B = 4 \times 8 = 32$	$h/2 = 4/2 = 2$	$32 \times 2 = 64$
2	$L \times B = 4 \times 4 = 16$ ✓	$h/2 = 4/2 = 2 + 4$ ✓ 6	$16 \times 6 = 96$ ✓
3	$\frac{1}{2}b \times h = \frac{1}{2} \times 4 \times 6 = 12$	$h/3 = 6/3 = 2 + 8 = 10$	$6 \times 9 = 120$
TOTAAL/TOTAL	60 ✓	✓	280 ✓
Swaartepunt = .....214/60 = 4,67..... ✓			

**FIG. 4.2** (10)

 RUIMTEDIAGRAM  
 SPACE DIAGRAM

 KRAGTEDIAGRAM  
 FORCE DIAGRAM

SKAAL / SCALE: 1 mm = 1 N



DEEL PART	GROOTTE SIZE	STUT STRUT	STANG TIE
BF	30 N	✓	
CG	0 N		
GF	30 N	✓	
GD	40 N	✓	
EF	26N		✓

<b>ANTWOORDBLAD</b> <b>ANSWER SHEET</b>	<b>B</b> <b>SIVIELE TEGNOLOGIE</b> <b>CIVIL TECHNOLOGY</b>	<b>NAAM:</b> _____
		<b>NAME:</b> _____

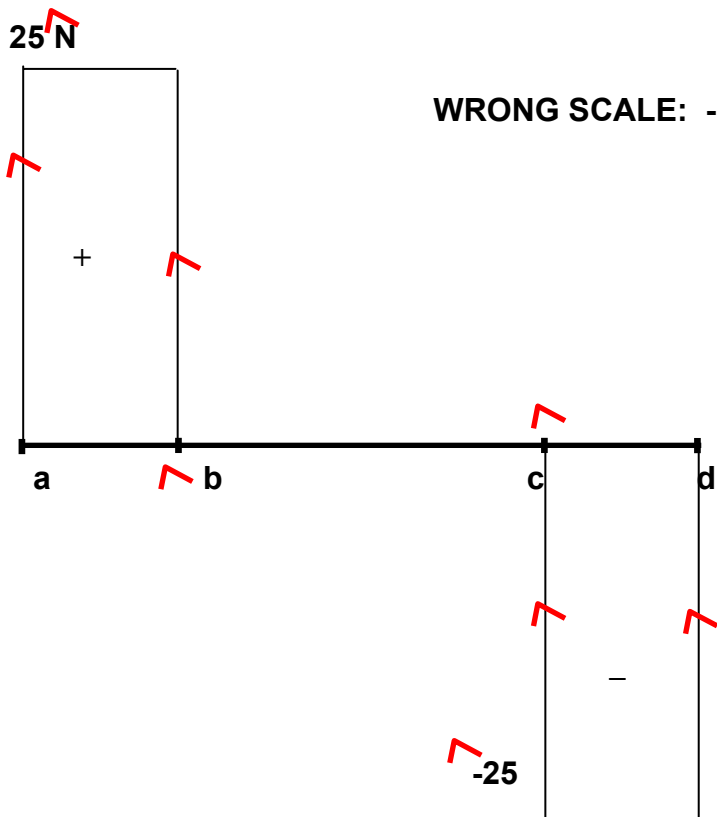
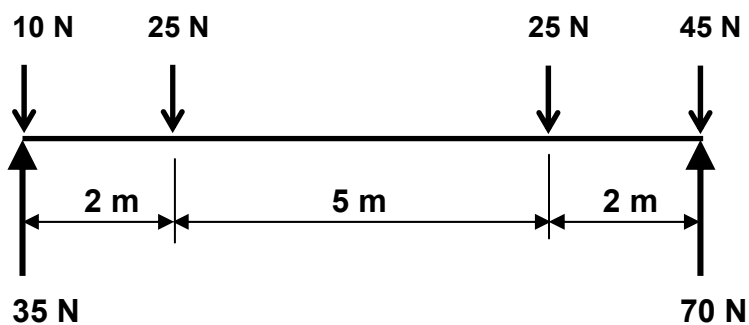
**FIG. 4.4**

4.4.1 Die skuifkragwaardes / The shear force values (4)

$$\begin{aligned}
 a &= \dots 35 - 10 = 25 \text{ N} \dots\dots\dots \\
 b &= \dots 25 - 25 = 0 \text{ N} \dots\dots\dots \\
 c &= \dots 0 - 25 = -25 \text{ N} \dots\dots\dots \\
 d &= \dots -25 + 70 - 45 = 0 \dots\dots\dots
 \end{aligned}$$

4.4.2 Die skuifkragdiagram / The shear force diagram (4)

**SCALE/SKAAL: 2 mm = 1 N**



<b>ANTWOORDBLAD</b> <b>ANSWER SHEET</b>	<b>C</b>	<b>SIVIELE TEGNOLOGIE</b>	<b>NAAM:</b> _____
		<b>CIVIL TECHNOLOGY</b>	<b>NAME:</b> _____

**FIG. 5.2 (21)**