SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN
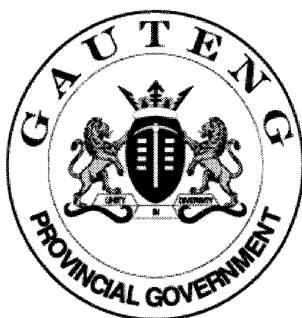
OCTOBER / NOVEMBER
OKTOBER / NOVEMBER

2004

TECHNIKA (CIVIL)

TECHNIKA (SIVIEL)

HG   712-1/0

12 pages
12 bladsye

TECHNIKA CIVIL HG
Question Paper & Answer Book

712 1 0   HG

GAUTENGSE DEPARTEMENT VAN ONDERWYS

SENIORSERTIFIKAAT-EKSAMEN

TECHNIKA (SIVIEL) HG

TYD: 3 uur

PUNTE: 300

BENODIGDHEDE:

- Antwoordboek
- Tekenantwoordboek
- Tekeninstrumente
- Sakrekenaar
- Antwoordblad HG 712-1/1 (1)

INSTRUKSIES:

- Hierdie vraestel bestaan uit TWEE afdelings, Afdeling A en Afdeling B.

- Afdeling A is VERPLIGTEND.

- Kandidate moet Afdeling A en enige TWEE vrae uit Afdeling B beantwoord.

- Alle berekeninge en skriftelike antwoorde moet in jou antwoordboek gedoen word; alle tekeninge in die tekenantwoordboek.

- Nommer die vrae soos dit op die eksamenvraestel verskyn.

- Toon die nommer van die vraag wat jy beantwoord, duidelik aan.

- Doen behoorlike beplanning.

- Tekeninge en sketse moet volledig gemaatskryf en netjies met die nodige opskrifte en byskrifte afgewerk word in ooreenstemming met die SABS se Aanbevole Praktyk vir Boutekene.

- Skryf jou eksamennommer op alle los bladsye, die tekenantwoordboek en op jou antwoordboek.

- Vir die doel van hierdie eksamen moet die baksteengrootte as 220 mm x 110 mm x 75 mm geneem word.

- Afmetings wat nie genoem of getoon word nie, moet volgens gestandaardiseerde mates geneem word.

- Geen "Tipp-Ex" mag gebruik word nie.

- Berekeninge moet tot die tweede desimale plek afgerond word.

- Antwoordblad HG 712-1/1 (1) is agter aan die vraestel geheg. Maak dit asseblief los en sit dit **in** jou antwoordboek nadat jy dit voltooi het.

GAUTENG DEPARTMENT OF EDUCATION
SENIOR CERTIFICATE EXAMINATION

TECHNIKA (CIVIL) HG

TIME: 3 hours

MARKS: 300

REQUIREMENTS:

- Answer book
- Drawing answer book
- Drawing instruments
- Pocket calculator
- Answer Sheet HG 712-1/1 (1)

INSTRUCTIONS:

- This question paper consists of TWO sections, Section A and Section B.

- Section A is COMPULSORY.

- Candidates must answer Section A and any TWO questions from Section B.

- All calculations and written answers must be done in your answer book; all drawings in the drawing answer book.

- Number the questions as they appear in the examination question paper.

- Clearly indicate the number of the question you are answering.

- Do proper planning.

- Drawings and sketches must be fully dimensioned and neatly finished with titles and labels to conform with the SABS Recommended Practice of Building Drawings.

- Write your examination number on all loose papers, the drawing answer book and your answer book.

- For the purpose of this examination, the size of a brick should be taken as 220 mm x 110 mm x 75 mm.

- Measurements not shown or given must be taken as standardised measurements.

- No Tipp-Ex may be used.

- Calculations to be rounded off to the second decimal.

- Answer Sheet HG 712-1/1 (1) is attached is at the back of this question paper. Please detach this answer sheet and place it **inside** your answer book after completing it.

AFDELING A
VERPLIGTEND

VRAAG 1

1.1 Noem enige VYF vereistes vir goeie beton. (10)

1.2 Noem enige VYF vereistes waaraan materiaal vir bekisting moet voldoen. (5)

1.3 Noem VIER belangrike redes waarom staalbewapening in 'n betonkonstruksie gebruik moet word. (4)

1.4 Skets VIER verskillende tipes betonstaalstawe. (4)

1.5 Noem enige VYF veiligheidsmaatreëls met betrekking tot die berging van materiaal. (10)

1.6 Noem enige VYF eienskappe van glas. (5)

1.7 Noem die minimum opgelegde belasting vir die volgende strukture:

    1.7.1 Sportsentrums (1)
    1.7.2 Hospitale (1)

1.8 Noem die kleurkodes vir die volgende bouwerk:

    1.8.1 Nuwe beton (1)
    1.8.2 Nuwe yster of staal (1)
    1.8.3 Nuwe glas (1)
    1.8.4 Alle bestaande materiaal (1)
    1.8.5 Nuwe messelwerk (1)

1.9 Meld enige TIEN veiligheidsmaatreëls wat op pypsteiers by 'n boukonstruksieperseel (bouprojek) van toepassing is. (10)

1.10 Noem VYF eienskappe van hout wat geskik sal wees vir dakkonstruksies. (5)
[60]

VRAAG 2

Die eerste vloer van 'n gebou bestaan uit 'n 150 mm dik betonvloer wat ondersteun word deur 'n 250 mm x 500 mm betonbalk.   Die totale hoogte van die vloer en balk is 500 mm.

Die vloer word bewapen met 19 mm ronde ysterstawe en die betonbalk met 'n I-balk.

Teken, volgens 'n skaal van 1:10, 'n vertikale snit deur die balk en 'n gedeelte van die vloer aan weerskante van die balk, om die bekisting, staalbewapening en die boonste deel van die stut in posisie te toon.

Toon ook hoe die vloer die eensteendik ongepleisterde buitemuur binnedring. **[60]**

SECTION A
COMPULSORY

QUESTION 1

1.1   Name any FIVE requirements of concrete.   (10)

1.2   Name any FIVE requirements of materials for shuttering.   (5)

1.3   Name FOUR important reasons why steel reinforcing must be used in a
        concrete construction.   (4)

1.4   Sketch FOUR different types of concrete steel rods.   (4)

1.5   Name any FIVE safety precautions when storing materials.   (10)

1.6   List any FIVE characteristics of glass.   (5)

1.7   State the minimum super-imposed load for the following structures:

         1.7.1   Sport centres   (1)
         1.7.2   Hospitals   (1)

1.8   Name the colour codes for the following building work:

         1.8.1   New concrete   (1)
         1.8.2   New iron or steel   (1)
         1.8.3   New glass   (1)
         1.8.4   All existing material   (1)
         1.8.5   New bricklaying   (1)

1.9   Name any TEN safety precautions which must be taken to ensure the safety of
        pipe scaffolding at a building construction site.   (10)

1.10   List FIVE characteristics of wood suitable for roof construction.   (5)
                                                                                                                           [60]

QUESTION 2

The first floor of a building consists of a 150 mm thick concrete floor which is
supported by a 250 mm x 500 mm concrete beam. The total height of the floor and
beam is 500 mm.

The floor is reinforced by 19 mm round bars, and the concrete beam, by means of a
I beam.

Draw, to a scale of 1:10, a vertical section through the beam and part of the floor on
both sides of the beam to show the formwork, steel reinforcement and the top section
of the prop in position.

Also show how the floor extends into the one-brick thick, unplastered external wall.   **[60]**

VRAAG 3

Figuur 1 hieronder toon 'n grondplan van 'n woonhuis wat opgerig moet word. Bereken die hoeveelheid stene wat benodig sal word vir die

3.1 fondasiemure. (330)
3.2 buitemure.
3.3 binnemure.
3.4 balkvulling.
3.5 hele gebou.

Slegs die hoeveelheid stene vir die deure en vensters moet afgetrek word.
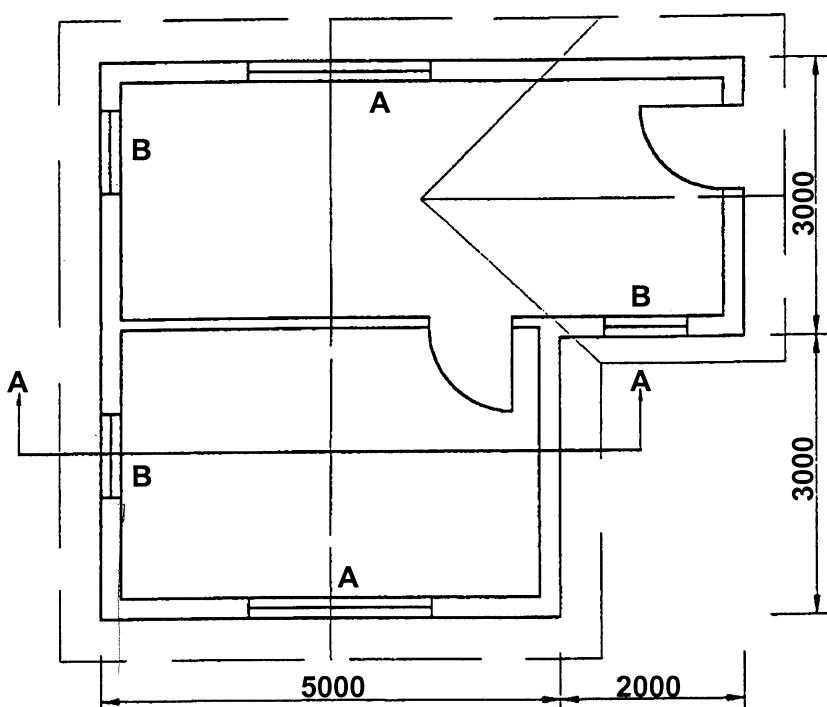
Figuur 1

Gebruik die volgende spesifikasies vir berekeningsdoeleindes:

- Gebruik 50 stene per vierkante meter vir 'n halfsteenmuur.
- Hoogte van die onderbou is 450 mm.
- Hoogte van die bobou is 2 800 mm.
- Hoogte van die balkvulling is 3 steenlae hoog.
- Deuropeninge is 2 000 mm x 900 mm.
- Venster A is 2 000 mm x 1 500 mm.
- Venster B is 1 500 mm x 900 mm.
- 'n 5% vermorsing van stene moet ook in die berekeninge ingesluit word.

Gebruik Antwoordblad HG 712-1/1 (1) om hierdie vraag te beantwoord. **[60]**

TOTAAL VIR AFDELING A: **[180]**

QUESTION 3

Figure 1 below shows a ground plan of a dwelling to be erected. Determine the number of bricks required for the

3.1   foundation walls. (330)
3.2   outer walls.
3.3   inner walls.
3.4   beam filling.
3.5   complete building.

**Only the number of bricks for the doors and windows must be deducted.**
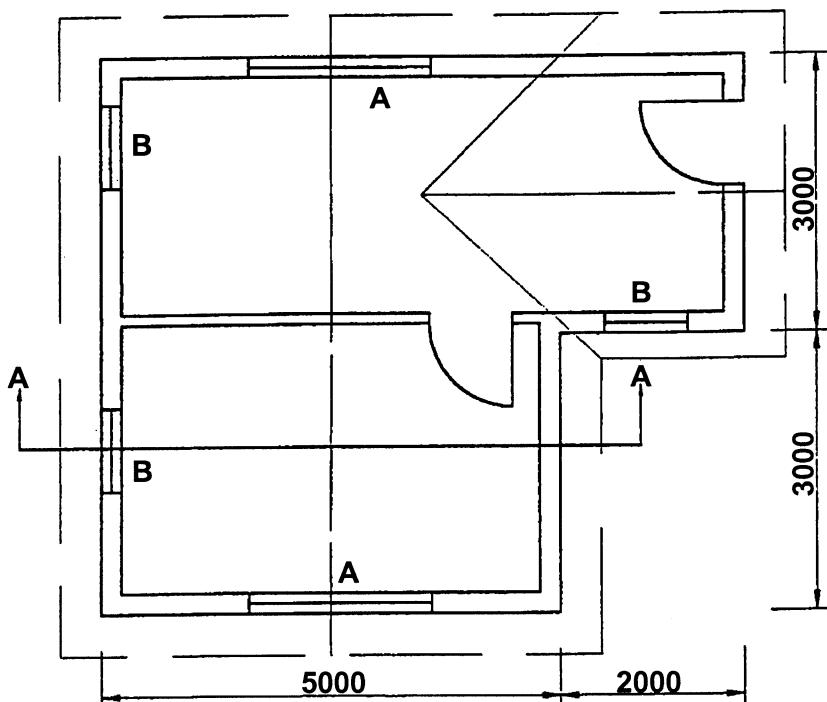
Figure 1

Use the following specifications for calculation purposes:

- Use 50 bricks per square metre for a half-brick wall.
- The height of the substructure is 450 mm.
- The height of the superstructure is 2 800 mm.
- The height of the beam filling is 3 layers of bricks.
- Door openings are 2 000 mm x 900 mm.
- Window A is 2 000 mm x 1 500 mm.
- Window B is 1 500 mm x 900 mm.
- A 5% wastage of bricks should also be included in the calculations.

Use Answer Sheet HG 712-1/1 (1) to complete this question.   **[60]**

TOTAL FOR SECTION A: **[180]**

AFDELING B

Beantwoord enige TWEE vrae uit hierdie afdeling.

VRAAG 4

'n Betonbalk 600 mm x 400 mm en vier meter lank rus op die ente op twee 400 mm x 400 mm vierkantige gewapende kolomme.

4.1   Teken volgens 'n skaal van 1:20, 'n vertikale snit deur die twee kolomme een meter bokant en een meter onderkant die betonbalk om die staalbewapening aan te toon. Toon ook duidelik hoe die kolom en die balk by mekaar aansluit.   (50)

4.2   Teken volgens 'n skaal van 1:5, 'n horisontale snit deur die boonste gedeelte van slegs een kolom 500 mm bokant die balk om die hegting van die kolomme aan te toon.   (10)

GEBRUIK DIE VOLGENDE SPESIFIKASIES OM DIE TEKENING TE VOLTOOI:

BEWAPENING VIR DIE BALK:

Gebruik DRIE hoofstawe 30 mm in diameter.

Gebruik TWEE ankerstawe 20 mm in diameter.

Gebruik TWEE skuifwapeningstawe 20 mm in diameter.

Gebruik AGTIEN beuels om die skuifkrag in die balk te weerstaan.

Die beuels het 'n diameter van 8 mm en word 150 mm hart-op-hart geplaas.

Gebruik VYF beuels van 8 mm in diameter op 300 mm hart-op-hart vir die res van die balk.

BEWAPENING VIR DIE KOLOM:

Gebruik VIER hoofstawe 30 mm in diameter en 2 600 mm in lengte.

Gebruik VIER stawe 30 mm in diameter om die boonste en onderste kolomme bymekaar te laat aansluit.

Gebruik AGTIEN vierkantige beuels om die hoofbewapening in die kolomme te heg.   **[60]**

SECTION B

Answer any TWO questions from this section.

QUESTION 4

A concrete beam 600 mm x 400 mm and four metres in length rests on its ends, on two 400 mm x 400 mm square reinforced columns.

4.1 Draw, to a scale of 1:20, a vertical section through the two columns one metre above and one metre below the concrete beam to show the reinforcing. Clearly show how the column and the beam join each other. (50)

4.2 Draw, to a scale of 1:5, a horizontal section through the top part of only one column 500 mm above the beam to show the fixture of the columns. (10)

USE THE FOLLOWING SPECIFICATIONS TO COMPLETE THE DRAWING:

REINFORCEMENT OF THE BEAM:

Use THREE main bars 30 mm in diameter.

Use TWO anchor-bars 20 mm in diameter.

Use TWO shear reinforcement bars 20 mm in diameter.

Use EIGHTEEN stirrups to withstand the shear force in the beam.

The stirrups have an 8 mm diameter and are placed 150 mm heart to heart.

Use FIVE stirrups of 8 mm in diameter on 300 mm heart to heart for the rest of the beam.

REINFORCEMENT FOR THE COLUMN:

Use FOUR main bars 30 mm in diameter and 2 600 mm in length.

Use FOUR rods 30 mm in diameter to attach the top and bottom columns to each other.

Use EIGHTEEN square stirrups to attach the main reinforcing in the beams. **[60]**

VRAAG 5

Figuur 2 toon 'n belaste balk wat op die punte ondersteun word.

Hierdie balk word met twee puntbelastings, asook 'n verspreide belasting van 3 kN/m belas.

5.1 Bereken die reaksie by die steunpunte.

5.2 Bereken die buigmomente by punte **A, B, C, D** en **E**.

5.3 Bereken die skuifkrag by punte **A, B, C, D** en **E**.

5.4 Teken die ruimte-, skuifkrag- en buigmomentediagramme.

Gebruik die volgende skale:

Ruimtediagram : 1:100

Buigmomentediagram : 3 mm = 1 kN/m

Skuifkragtediagram : 5 mm = 1 kN
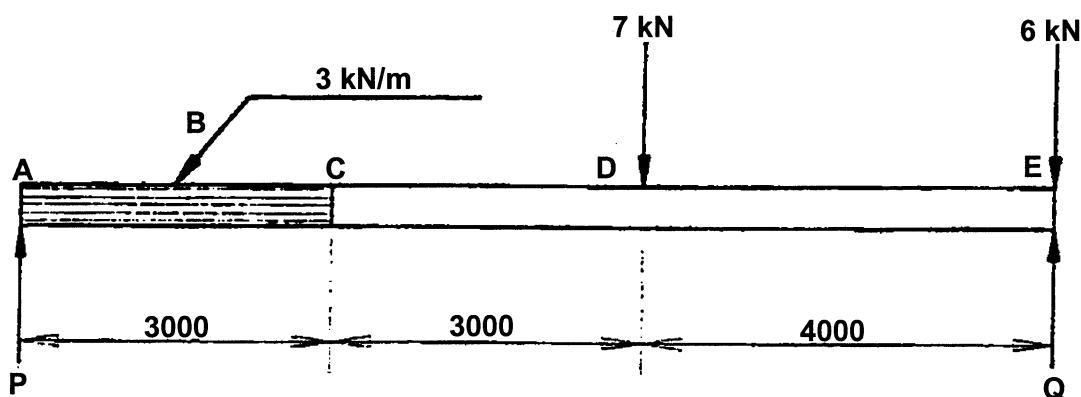
Figuur 2   **[60]**

QUESTION 5

Figure 2 shows a loaded beam supported at the ends.

This beam has a distributed load of 3 kN/m as well as two point loads.

5.1   Calculate the reactions at the supports.

5.2   Calculate the bending moments at points **A, B, C, D** and **E**.

5.3   Calculate the shear force at points **A, B, C, D** and **E**.

5.4   Draw the space, shear force and bending moment diagrams.

Use the following scales:

Space diagram   :   1:100

Bending moment diagram   :   3 mm = 1 kN/m

Shear force diagram   :   5 mm = 1 kN
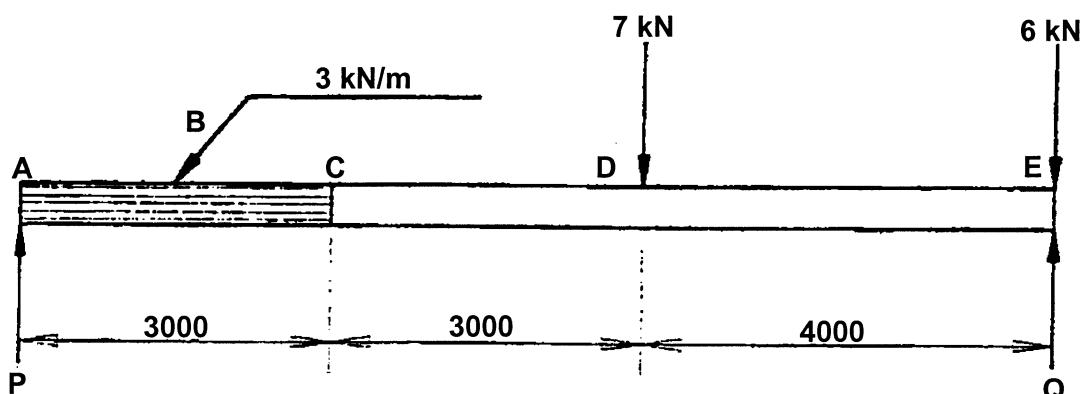
Figure 2   [60]

VRAAG 6

Figuur 3 toon 'n raamwerk met vertikale puntbelastings.

6.1 Bereken die reaksies by die steunpunte.

6.2 Teken die ruimtediagram deur gebruik te maak van 'n 1:5 skaal.

6.3 Teken die vektordiagram volgens 'n skaal van 20 mm = 1 kN.
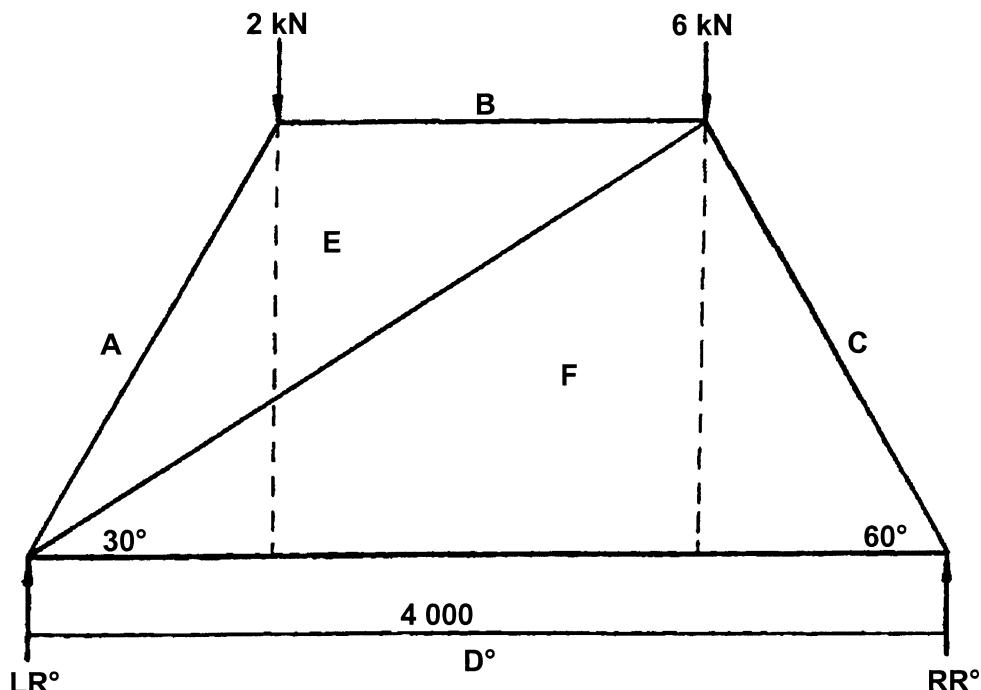
Figuur 3

6.4 Bepaal grafies die aard en grootte van die kragte wat op elke onderdeel van die raamwerk inwerk.
Teken die onderstaande tabel in jou antwoordboek oor en beantwoord Vraag 6.4 daarin.

ONDERDEEL	AARD	GROOTTE
EF		
CF		
AE		
DF		
BE		

[60]

b.o.

QUESTION 6

Figure 3 shows a framework with vertical point loads.

6.1 Calculate the reactions at the supports.

6.2 Draw the space diagram by using a scale of 1:5.

6.3 Draw the vector diagram according to a scale of 20 mm = 1 kN.
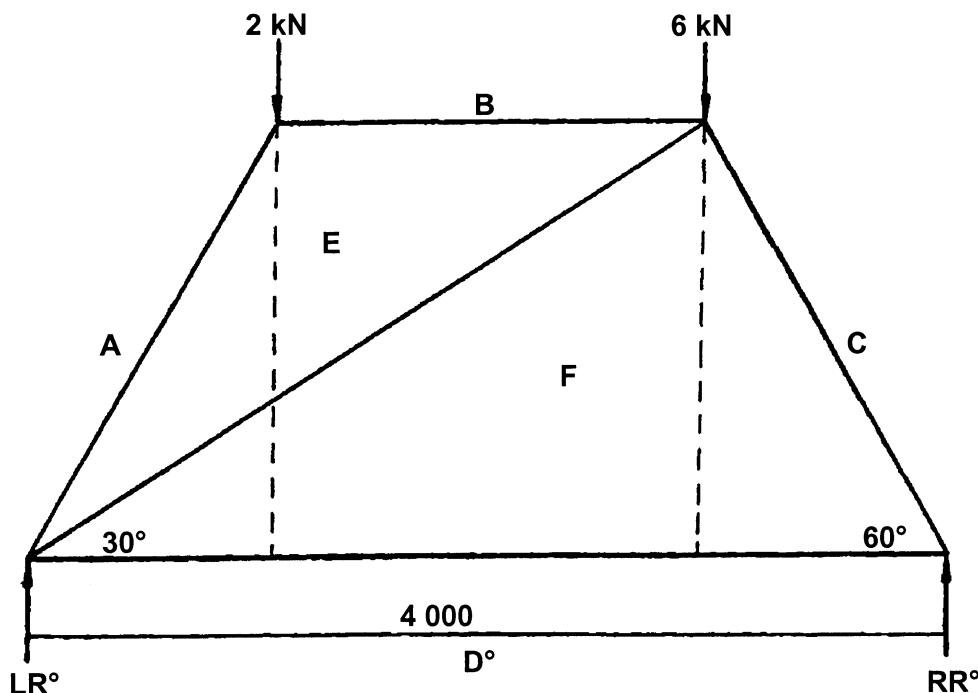

Figure 3

6.4 Determine graphically the nature and magnitude of the force in each member of the framework.
Draw the table below in your answer book and answer Question 6.4 within the table.

MEMBER	NATURE	MAGNITUDE
EF		
CF		
AE		
DF		
BE		

[60]

VRAAG 7

Figuur 4 toon 'n grondplan van 'n woonhuis. Die 30° skilddak is bedek met sinkplaat en het 'n 500 mm oop oorhang. Die dakafwerking is 'n 200 mm asbesfassiebord waaraan die 100 mm vierkantige geute met 75 mm afleipype geheg is.

Die bobou is 2 900 mm en die onderbou 300 mm hoog. Die vensterbanke is afgewerk met 30 mm kleiteëls. Die deure is geraam, geklamp en verspan en pas in 'n 75 mm kosyn.

Teken, volgens 'n skaal van 1:100, die noord- en wesaansigte van hierdie woonhuis.

Gebruik die vensterskedule vir die vensteргroottes.

Toon ook deur middel van 'n skaaltekening hoe die dakhoogtes bepaal word.

[60]
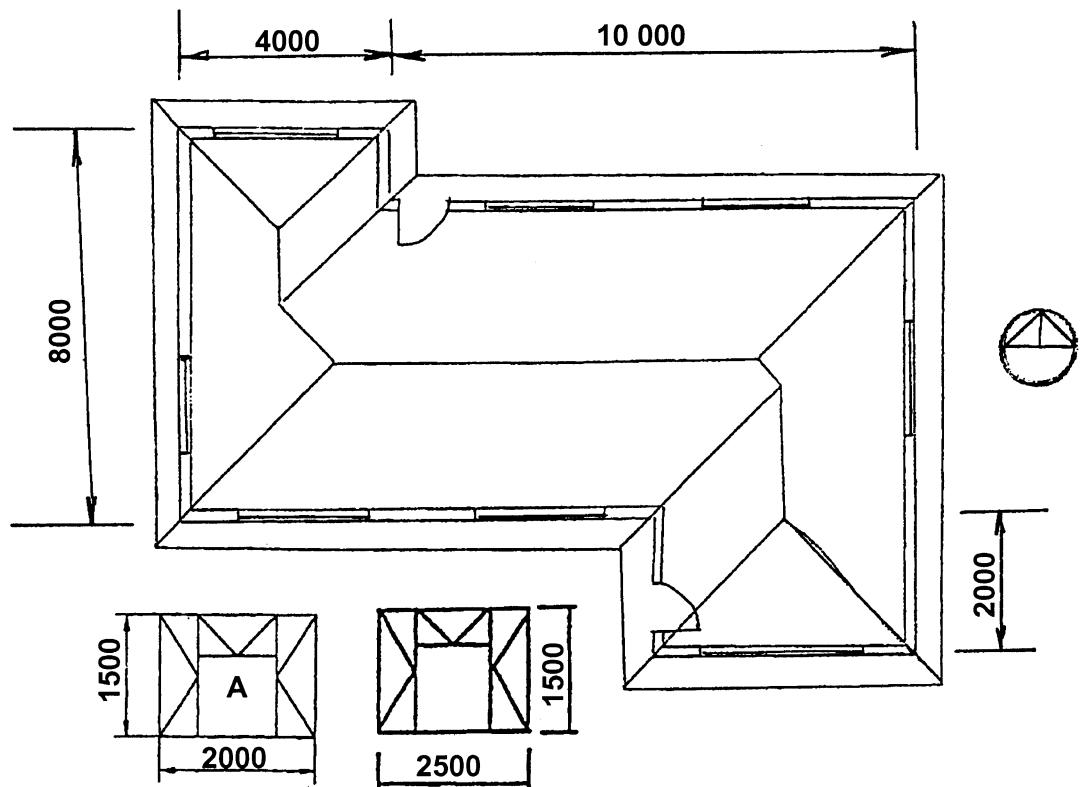
TOTAAL VIR AFDELING B: [120]

TOTAAL: 300

b.o.

QUESTION 7

Figure 4 shows a floor plan of a dwelling. The 30° gable roof is covered with corrugated iron and has a 500 mm open eave. The roof is finished with a 200 mm asbestos fascia board to which the 100 mm square gutter and 75 mm downpipes are attached.

The superstructure is 2 900 mm and the substructure 300 mm high. The window sills are finished with 30 mm clay tiles. The doors are framed, ledged and braced, fitting into a 75 mm casement.

Draw, to a scale of 1:100, the north and west views of this dwelling.

Use the window schedule for the window sizes.

Show by means of a scale drawing how the roof heights are determined.

[60]
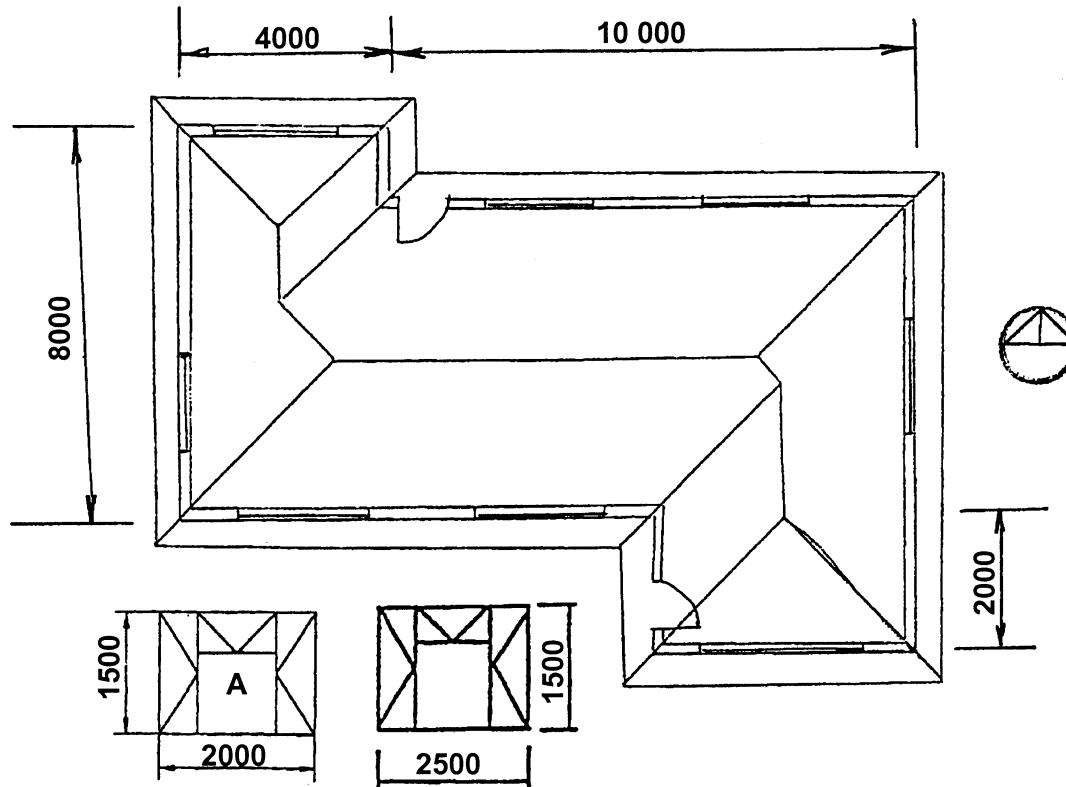
Figure 4

TOTAL FOR SECTION B: [120]

TOTAL: 300

ANSWER SHEET / *ANTWOORDBLAD* HG 712-1/1 (1)

EXAMINATION NUMBER / *EKSAMENNOMMER*:

CENTRE NUMBER / *SENTRUMNOMMER*:

- Please detach the answer sheet (pages 9 – 15) and place it **inside** your answer book upon completion / *Maak asseblief die antwoordblad (bladsy 9 – 15) los en plaas dit **binne-in** jou antwoordboek wanneer jy dit voltooi het.*

- Write your examination number in the spaces provided. / *Skryf jou eksamennommer in die spasies wat daarvoor voorsien is.*

NOTE / *NOTA*

Fill in the missing answer in the block [   ].

Vul die ontbrekende antwoord in die blok [   ] in.

e.g. / *bv.*

Minus 4 x [   ] = [   ]

ANSWER / *ANTWOORD*

Minus 4 x **[110]** = **[440]**

A	B	C	D
			Substructure centre line / Onderbou hartlyn
			2 x [ ] = [ ] mm
			2 x [ ] = [_____] mm
			[ ] mm
			Minus 4 x [ ] = [_____] mm
			[ ] mm
			The centre line is / Die hartlyn is [ ] metres/meter.
			Height of the substructure is [ ] mm
			Hoogte van die onderbou is [ ] mm
			50 bricks per square metre for a half-brick wall.
			50 stene per vierkante meter vir 'n halfsteenmuur.
			There are [ ] half-brick walls.
			Daar is [ ] halfsteenmure.
1/	[ ] [_____] [ ]	[ ]	
[ ]/	[ ] [_____] [ ]	[ ]	[ ] bricks are required. Daar is [ ] stene nodig.
			Superstructure centre line / Bobou hartlyn
			2 x [ ] = [ ] mm
			2 x [ ] = [_____] mm
			[ ] mm
			Minus 4 x [ ] = [_____] mm
			[ ] mm
			The centre line is / Die hartlyn is [ ] metres/meter.
			Height of the superstructure is [ ] mm.
			Hoogte van die bobou is [ ] mm.
			50 bricks per square metre for a half-brick wall.
			50 stene per vierkante meter vir 'n halfsteenmuur.
			There are [ ] half-brick walls.
			Daar is [ ] halfsteenmure.
1/	[ ] [_____] [ ]	[ ]	
[ ]/	[ ] 50 [ ]	[ ]	[ ] bricks are required. Daar is [ ] stene nodig.

			Inner wall centre line / *Binnemuur hartlyn*
			1 x [ ] = [ ]
			The centre line is / *Die hartlyn is* [ ] metres/*meter.*
			Height of the superstructure is 2 800 mm.
			Hoogte van die bobou is 2 800 mm.
			50 bricks per square metre for a half-brick wall
			50 stene per vierkante meter vir 'n halfsteenmuur
			There is [ ] half-brick wall.
			Daar is [ ] halfsteenmuur.
1/	[ ]		
	[ ]	[ ]	
	[ ]		
[ ]	[ ]		[ ] bricks are required.
	50	[ ]	*Daar is [ ] stene nodig.*
	[ ]		
			Total for structure without deductions
			Totaal van struktuur sonder aftrekkings
			Substructure/ *Onderbou* [ ]
			Superstructure / *Bobou* [ ]
			Beam filling / *Balkvulling* [ ]
			Inner wall / *Binnemuur* [ ]
			[ ] Bricks / *Stene*
			Deductions / *Aftrekkings*
			Doors / *Deure*
			2 x 2 x 0,9
			50 bricks per square metre for a half-brick wall.
			50 stene per vierkante meter vir 'n halfsteenmuur.
			There are [ ] half-brick walls.
			Daar is [ ] halfsteenmure.
2/	2		
	[ ]	[ ]	
	[ ]		
[ ]/	[ ]		There are [ ] bricks.
	50	[ ]	*Daar is [ ] stene.*
	[ ]		

			Windows / *Vensters*
			Window / *Venster* A
			[ ] x 2 x 1.5
			50 bricks per square metre for a half-brick wall
			50 stene per vierkante meter vir 'n halfsteenmuur
			There are [ ] half-brick walls.
			Daar is [ ] halfsteenmure.
2/	2		
	[ ]	[ ]m	
[ ]/	[ ]		There are [ ] bricks.
	50	[ ]	*Daar is [ ] stene.*
	[ ]		
			Window / *Venster* B
			[ ] x 0.900 x 1.5
			50 bricks per square metre for a half-brick wall.
			50 stene per vierkante meter vir 'n halfsteenmuur.
			There are 2 half-brick walls.
			Daar is 2 halfsteenmure.
[ ]/	0,9		
	1,5	[ ]m	
	1,35		
2/	[ ]		There are [ ] bricks.
	50	[ ]	*Daar is [ ] stene.*
	[ ]		
			Total Deductions / *Totale aftrekkings*
			Doors / *Deure* [ ]
			Windows / *Vensters*[ ]
			[ ] Bricks / *Stene*
			Total bricks for the structure
			Totale stene vir die struktuur
			Structure / *Struktuur* [ ]
			Deductions / *Aftrekkings* [ ]
			[ ]
			Plus [ ] % Wastage / *Vermorsing*
			[ ]
			x [ ]
			[ ]
			[ ]
			plus [ ]
			[ ]
			[ ] bricks will be required for the structure
			Daar sal [ ] stene nodig wees vir die struktuur.

END / *EINDE*