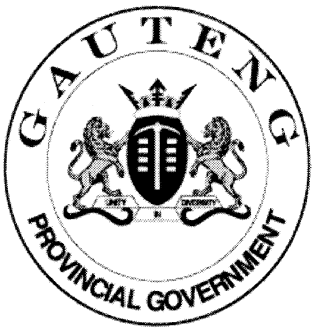
SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN



OCTOBER / NOVEMBER
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2004

WELDING AND METALWORKING

SWEIS- EN METAAL-BEWERKING

SG **716-2/0**

WELDING & METALWORKING SG
Question Paper & Answer Book

10 pages
10 bladsye

GAUTENGSE DEPARTEMENT VAN ONDERWYS
SENIORSERTIFIKAAT-EKSAMEN

SWEIS- EN METAALBEWERKING SG

TYD: 3 uur

PUNTE: 200

BENODIGHEDE:

- Antwoordboek
- Tekenantwoordboek 716-2/X
- Tekeninstrumente en sakrekenaar

INSTRUKSIES:

- Jy moet VYF vrae beantwoord.
- Beantwoord VRAAG 1 en enige VIER ander vrae.
- Nommer jou antwoorde in ooreenstemming met die vraestel.

VRAAG 1
VERPLIGTEND

1.1 Dui aan of die volgende stellings WAAR of ONWAAR is. Skryf slegs die vraagnommer en daarnaas WAAR of ONWAAR in jou antwoordboek neer.

1.1.1 Interne sweisdefekte kan deur middel van die x-straalmetode opgespoor word.

1.1.2 Die buigtoets is 'n nie-vernietigende toets.

1.1.3 Spanning is die interne krag in materiaal wat 'n las teewerk (weerstaan).

1.1.4 Vormverandering is die lengte waarmee 'n staaf verkort of verleng word wanneer 'n eksterne las daarop toegepas word.

1.1.5 In die solderkamer, word lang reguit lyne met bordkryt getrek.

1.1.6 Maatvorms word gebruik gedurende stapelboor.

1.1.7 Soos wat die koolstofinhoud van staal verhoog, sal die staal minder en minder verhard kan word.

1.1.8 Deur die absorbering van vogtigheid, sal elektrodes (sweisstafies) heeltemal onbruikbaar wees.

GAUTENG DEPARTMENT OF EDUCATION
SENIOR CERTIFICATE EXAMINATION

WELDING AND METALWORKING SG

TIME: 3 hours

MARKS: 200

REQUIREMENTS:

- Answer book
- Drawing Answer book 716-2/X
- Drawing instruments and pocket calculator

INSTRUCTIONS:

- You must answer FIVE questions.
- Answer QUESTION 1 and any FOUR other questions.
- Number your answers in accordance with the question paper.

QUESTION 1
COMPULSORY

1.1 Indicate whether the following statements are TRUE or FALSE. In your answer book, write down only the question number and next to it TRUE or FALSE.

1.1.1 Internal welding defects can be detected by the x-ray method.

1.1.2 The bend test is a non-destructive test.

1.1.3 Stress is an internal force in material resisting a load.

1.1.4 Deformation is the length with which a bar is shortened or lengthened when an external load is applied to it.

1.1.5 In the template loft, long straight lines are made with a chalk.

1.1.6 Templates are used during stack drilling.

1.1.7 As the carbon content of steel is increased, the steel will become less and less hardened.

1.1.8 Through the absorption of moisture, electrodes (welding rods) may become entirely unusable.

1.1.9 'n Enkellopieneerslag verhoog hardheid.

1.1.10 Die afkoeling van onderdele voordat dit gesweis word, sal krake in 'n sweislas voorkom.

1.1.11 'n Sweissimbool is 'n ideogram wat gebruik word om 'n verlangde sweislas aan te dui.

1.1.12 Beskadigde stroppe moet met absolute versigtigheid gebruik word.

1.1.13 Die AC2-punt is die belangrikste punt op die yster-koolstofdiagram.

1.1.14 Gedurende die konstruksie van 'n kroonprofiel word die diepte met 80% vermeerder.

1.1.15 Gekskeerdery in die werkswinkel word as 'n onveilige toestand beskou. (15)

1.1.9 A single run deposit increases hardness.

1.1.10 The cooling of parts before welding starts will prevent cracks in a weld.

1.1.11 A weld symbol is an ideograph used to indicate the desired type of weld.

1.1.12 Damaged slings must be used with absolute caution.

1.1.13 The AC2 point is the most important point on the iron-carbon diagram.

1.1.14 In the construction of a castellated beam the depth is increased by 80%.

1.1.15 Fooling around in the workshop is considered to be an unsafe practice. (15)

1.2 Kies die regte antwoord in **KOLOM B** om te pas by die inligting in **KOLOM A**. Skryf die regte letter langs die ooreenstemmende vraagnommer in jou antwoordboek neer.

VOORBEELD: 1.2.21 – U

	KOLOM A		KOLOM B
1.2.1	Dik papier, hardebord en dun staalplate is	A.	elimineer (skakel) verharding uit
1.2.2	Steke op maatvorms wissel tussen	B.	help om distorsie (skeeftrekking) te voorkom
1.2.3	Maatvorms word gebruik om	C.	is die belangrikste faktore gedurende die hittebehandeling van staal
1.2.4	Kroonprofiele is 'n eenvoudige maar effektiewe manier om	D.	veroorsaak 'n oormatige opbou van sweismetaal
1.2.5	Vooraf verhitting van die moedermetaal met 'n 0,3% koolstofinhoud sal	E.	neergelegde laag onsuiwerhede van die bedekking van 'n elektrode (sweisstafie)
1.2.6	Die gebruik van klampe, hegstukke of setapparaat sal	F.	die diepte tot waar samesmelting in die moedermetaal plaasgevind het
1.2.7	Klop is 'n metode om	G.	'n kraak in die krater van 'n sweiskraal
1.2.8	Hegsweising	H.	van die materiale wat gebruik word vir maatvorms
1.2.9	Onderbroke sweislaste	I.	brandstof, elektrisiteit, huur en herstelwerk
1.2.10	Finale temperatuur, tyd en die metode van afkoeling	J.	bespaar geld, tyd en vermorsing van materiaal
1.2.11	Sweisspoed wat te stadig is, sal	K.	lae koolstofstale
1.2.12	'n Sweisstroom wat te hoog is, sal	L.	koolstof word by yster gevoeg
1.2.13	Die gebruik van minderwaardige elektrodes (sweisstafies) sal	M.	vervorming en herkristallisering vind op hierdie stadium gelyktydig plaas
1.2.14	Neerslag is 'n	N.	sal die inkrimpingskrag van 'n sweislas verminder
1.2.15	Samesmeltingsgebied	O.	is die vinnige prosedure om die beweging van onderdele te verhoed
1.2.16	Staal word gevorm wanneer	P.	die las met hamerslae te bewerk
1.2.17	Kraterkraak	Q.	om die sterkte van 'n gedeelte te verhoog sonder om die massa te verhoog
1.2.18	Hierdie elemente vorm deel van drakoste (oorhoofse koste)	R.	veroorsaak sweisdefekte
1.2.19	Dopverharding kan toegepas word op	S.	veroorsaak inkarteling
1.2.20	Warmbewerking	T.	3-5d

(20)

1.2 Choose the correct answer in **COLUMN B** to fit the information in **COLUMN A**. Write only the correct letter next to the corresponding question number in your answer book.

EXAMPLE: 1.2.21 – U

	COLUMN A		COLUMN B
1.2.1	Thick paper, hardboard and thin steel plates are	A.	eliminate hardening
1.2.2	Pitches on templates vary between	B.	help to avoid distortion
1.2.3	Templates are used to	C.	are the most important factors during the heat-treatment of steel
1.2.4	Castellated beams are a simple but clever method	D.	result in an excessive piling up of weld metal
1.2.5	Preheating of the parent metal with a 0,3% carbon content will practically	E.	deposited layer of impurities from the coating of an electrode
1.2.6	The use of clamps, fixtures or jigs will	F.	the depth to which the parent metal has been fused
1.2.7	Peening is a method	G.	a crack in the crater of a weld bead
1.2.8	Tack welding	H.	some of the materials used for templates
1.2.9	Intermittent welds	I.	fuel, electricity, rent, repairs
1.2.10	Final temperature, time and the method of cooling	J.	save money, time and wastage of material
1.2.11	Welding speed which is too slow will	K.	low carbon steels
1.2.12	Welding current which is too high will	L.	carbon is added to iron
1.2.13	Using inferior electrodes (welding rods) will	M.	deformation and recrystallisation occur at this point simultaneously
1.2.14	Slag is a	N.	will reduce the shrinkage force in a weld
1.2.15	Fusion zone	O.	is a quick procedure for preventing the movement of parts
1.2.16	Steel is formed when	P.	by working the joint with hammer blows
1.2.17	Crater crack	Q.	of increasing the strength of a section without increasing the mass
1.2.18	These elements form part of overhead costs	R.	cause weld defects
1.2.19	Case-hardening can be performed on	S.	cause undercutting
1.2.20	In hot working,	T.	3-5d

(20)

1.3 Dui die korrekte antwoord aan deur **slegs** die regte letter langs die ooreenstemmende vraagnommer neer te skryf.

1.3.1 Die eenheid van vormverandering is:

A. Pascal
B. Meter
C. Newton
D. Dit het geen eenheid nie.

1.3.2 Boogsweiswerk met 'n te hoë stroom, sal _____.

A. swak penetrasie veroorsaak
B. geen spatsels agterlaat nie
C. inkarteling veroorsaak
D. 'n perfekte sweislas agterlaat

1.3.3 Koolstof word by _____.

A. staal gevoeg om yster te vorm
B. yster gevoeg om staal te vorm
C. vlekvrye staal gevoeg om hardheid te verkry
D. koper gevoeg sodat dit verhard kan word

1.3.4 Gedurende die verhardingsproses is die _____.

A. finale temperatuur, tyd en die afkoelingsproses die belangrikste faktore
B. koolstof- en suurstofinhoud die belangrikste faktore
C. tipe staal wat gebruik word, die belangrikste faktore
D. legeringselemente die belangrikste faktore

1.3.5 Hegsweiswerk word gebruik om _____.

A. te verhoed dat metaal gedurende die sweisproses buig
B. te help dat die metale stil lê gedurende die sweisproses
C. inkrimping te voorkom
D. te verhoed dat die metale wat gesweis gaan word, weg van mekaar af trek tydens die sweisproses

1x5=(5)
[40]

1.3 Choose the correct answer by writing **only** the correct letter next to the corresponding question number.

1.3.1 The unit for strain is:

A. Pascal
B. Metre
C. Newton
D. It has no unit.

1.3.2 Arc welding with a too high current will _____.

A. produce bad penetration
B. leave no spatter
C. cause an undercut
D. produce a perfect welding joint

1.3.3 Carbon is _____.

A. added to steel to form iron
B. added to iron to form steel
C. added to stainless steel to obtain hardness
D. added to copper in order for it to be hardened

1.3.4 During the hardening process the _____.

A. final temperature, time and the method of cooling are the most important factors
B. carbon and oxygen content are the most important factors
C. type of steel used is the most important factor
D. alloying element is the most important factor

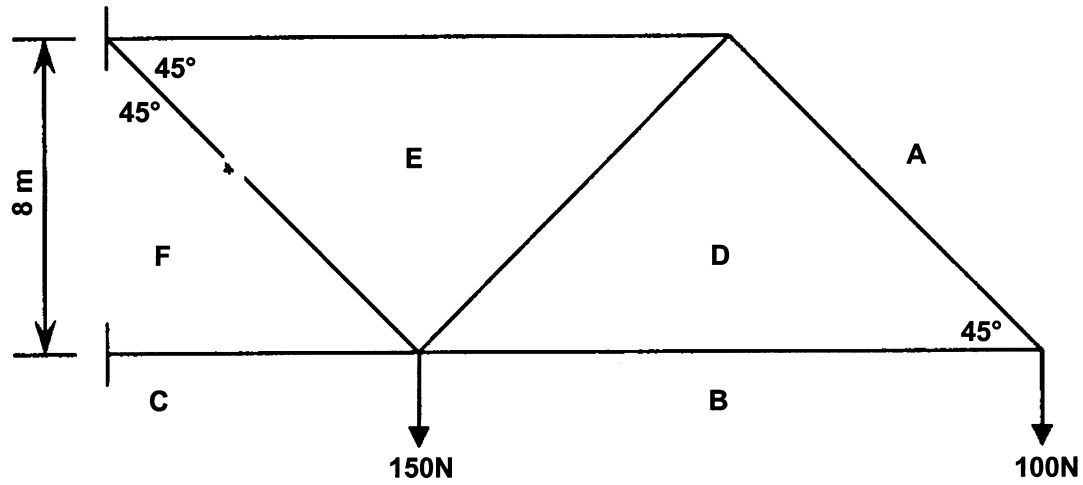
1.3.5 Tack weld is applied _____.

A. to avoid the metal from bending during the welding process
B. in order to help the metals lie still during the welding process
C. to prevent shrinkage
D. to prevent the metals from moving apart during the welding process

1x5=(5)
[40]

VRAAG 2

2.1 **Figuur 1** toon 'n lyndiagram van 'n raamwerk met TWEE vertikale belastings.



Figuur 1

2.1.1 Teken die kragtediagram volgens 'n skaal van 10 mm : 25 N. (8)

2.1.2 Bepaal die grootte en aard van die kragte in elke onderdeel van die raamwerk. Teken en voltooi die onderstaande tabel in jou antwoordboek. (12)

		KRAG - N	
ONDERDEEL	AFMETING	STANG	STUT
DA			
DB			
DE			
FE			
FC			
EA			

2.1.3 Teken die ruimtediagram volgens 'n skaal van 1:2 en toon die aard van die kragte in elke onderdeel aan. (6)

QUESTION 2

2.1 **Figure 1** shows a line diagram of a framework with TWO vertical loads.

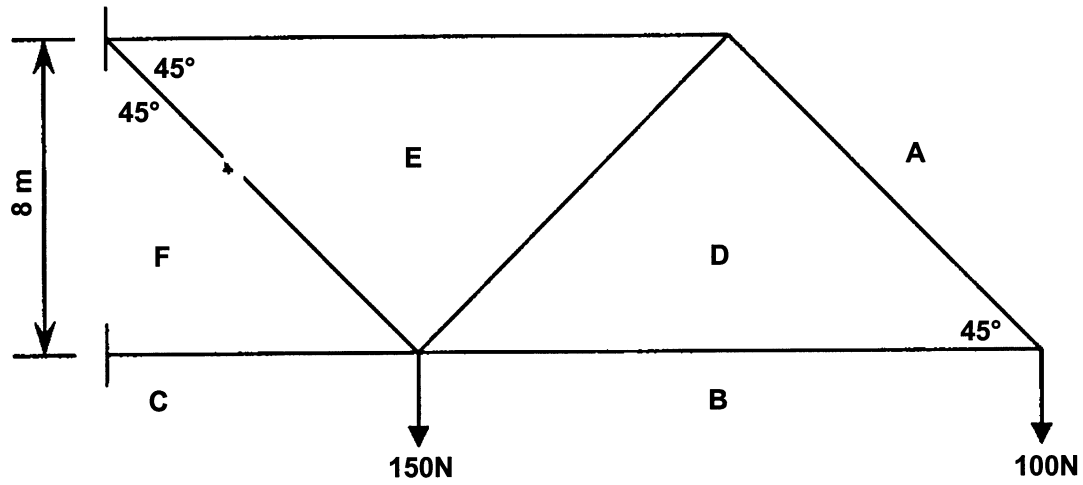


Figure 1

2.1.1 Draw the force diagram to a scale of 10 mm : 25 N. (8)

2.1.2 Determine the magnitude and nature of the forces in each component of the framework. Copy and complete the following table in your answer book. (12)

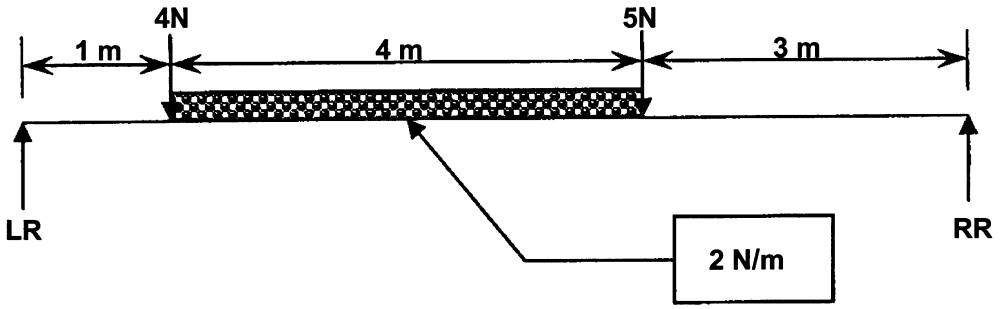
		FORCE - N	
MEMBER	MEASUREMENT	TIE	STRUT
DA			
DB			
DE			
FE			
FC			
EA			

2.1.3 Draw the space diagram to a scale of 1 : 2 and indicate the nature of the forces in each component. (6)

2.2 **Figuur 2** toon 'n eenvoudig ondersteunde balk met twee vertikale puntbelastings, asook 'n verspreide belasting van 2 N/m tussen die twee vertikale puntbelastings.

2.2.1 Verander die verspreide belasting na 'n puntbelasting (toon jou berekeninge). (2)

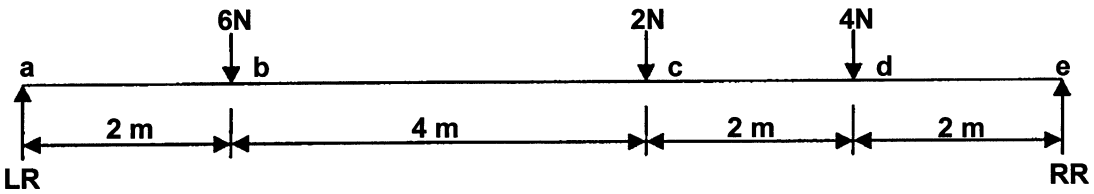
2.2.2 Bereken die linker- en regterreaksies van die balk. (12)
[40]



Figuur 2

VRAAG 3

Figuur 3 verteenwoordig 'n eenvoudig ondersteunde balk wat aan drie vertikale puntbelastings onderwerp is. Die balk is 10 meter lank.



Figuur 3

3.1 Toon aan deur berekeninge dat die linker- en regterreaksies onderskeidelik 10,4 N en 6,6 N is. (10)

3.2 Bereken die buigmomente by punte **A**, **B**, **C**, **D** en **E**. (6)

3.3 Bereken die skuifkragte by elke punt. (8)

3.4 Teken die buigmomentdiagram volgens 'n skaal **5 mm : 1 Nm**. (8)

3.5 Teken die skuifkragdiagram volgens 'n skaal **10 mm : 1 N**. (8)
[40]

2.2 **Figure 2** shows a simple supported beam with two vertical point loads as well as a distributed load of 2 N/m between the two vertical point loads.

2.2.1 Change the distributed load to a point load. Show all calculations. (2)

2.2.2 Calculate the left and right reactions of the beam. (12)
[40]

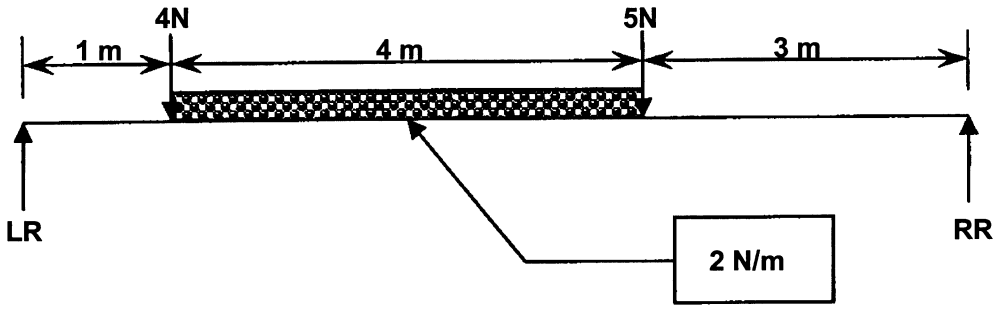


Figure 2

QUESTION 3

Figure 3 represents a simple supported beam which is subjected to three vertical point loads. The beam is 10 metres long.

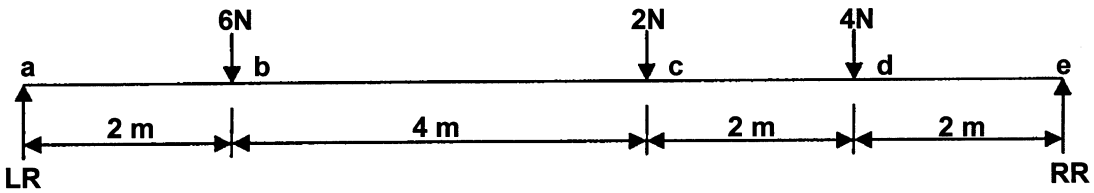


Figure 3

3.1 Indicate by means of calculations that the left and the right reactions are 10,4 N and 6,6 N respectively. (10)

3.2 Calculate the bending moments at points **A**, **B**, **C**, **D** and **E**. (6)

3.3 Calculate the shear forces at each point. (8)

3.4 Draw the bending moment diagram by using a scale of **5 mm : 1 Nm**. (8)

3.5 Draw the shear force diagram to a scale of **10 mm : 1 N**. (8)
[40]

VRAAG 4

4.1 'n 30 mm ronde staaf word aan 'n trektoets onderwerp. Die aanvanklike lengte van die toetsstuk voor die toets was 100 mm en die finale lengte van die toetsstuk was 106 mm. Young se modulus vir die staaf is 180 GPa:

4.1.1 Bereken die verandering in lengte. (3)
4.1.2 Bereken die vormverandering in die staaf. (5)
4.1.3 Bereken die spanning in die staaf gedurende die toets. (5)
4.1.4 Skakel 30 mm om na meter en bereken die oppervlakte van die staaf. (7)
4.1.5 Bereken die belasting wat vir die toets gebruik is. (5)

4.2 Bereken die diameter van 'n staaf indien dit 'n interne spanning van 1.2 GPa en 'n krag van 381,9 kN het. Rond jou antwoord af tot die naaste mm. (15)

$$\text{Spanning (Pa)} = \frac{\text{Belasting (N)}}{\text{Oppervlakte (m}^2\text{)}}$$

$$\text{Vormverandering} = \frac{\text{Vervorming (mm) / (m)}}{\text{Oorspronklike lengte (mm) / (m)}}$$

$$\text{Young se Modulus (Pa)} = \frac{\text{Spanning(Pa)}}{\text{Vormverandering}}$$

[40]

QUESTION 4

4.1 A 30 mm round bar is subjected to a tensile test. The original length of the test piece before the test was 100 mm and the final length of the test piece was 106 mm. Young's modulus for the bar equals 180 GPa:

4.1.1 Calculate the change in length. (3)
4.1.2 Calculate the strain in the bar. (5)
4.1.3 Calculate the stress in the bar during the test. (5)
4.1.4 Convert 30 mm to metres and calculate the area of the bar. (7)
4.1.5 Calculate the force used for the test. (5)

4.2 Calculate the diameter of a bar if it has an internal stress of 1.2 GPa and a force of 381,9 kN. Round off your answer to the nearest mm. (15)

$$\text{Stress (Pa)} = \frac{\text{Force (N)}}{\text{Area (m}^2\text{)}}$$

$$\text{Strain} = \frac{\text{Deformation (mm) or (m)}}{\text{Original length (mm) or (m)}}$$

$$\text{Young's Modulus (Pa)} = \frac{\text{Stress (Pa)}}{\text{Strain}}$$

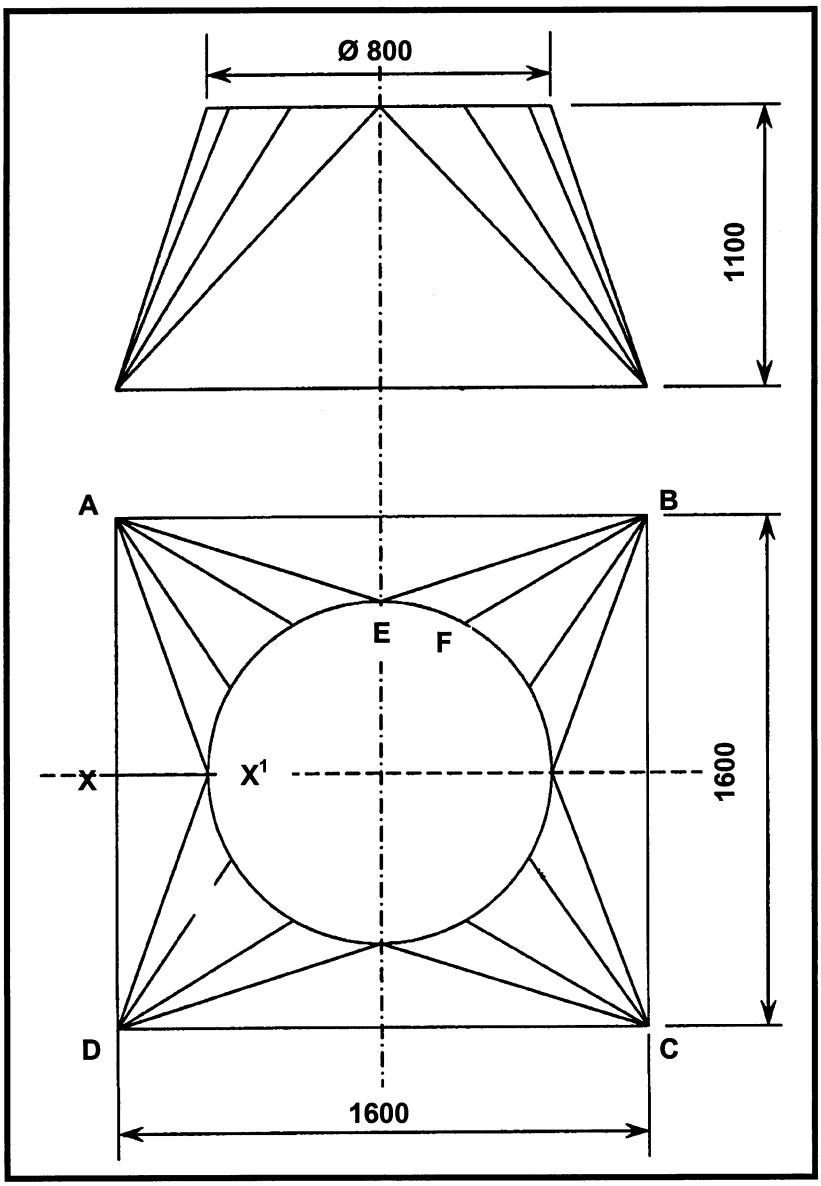
[40]

VRAAG 5

5.1 **Figuur 4** toon 'n vierkant na rond-ontwikkeling. Die afmeting van die vierkantbasis 1600 mm x 1600 mm en die diameter by die bopunt is 800 mm. Die hoogte van die ontwikkeling is 1100 mm.

Bereken:

5.1.1 Die ware lengte van die plaat by XX^1 (9)
5.1.2 Die ware lengte van BE^1 (10)
5.1.3 Die ware lengte van BF^1 (21)



[40]

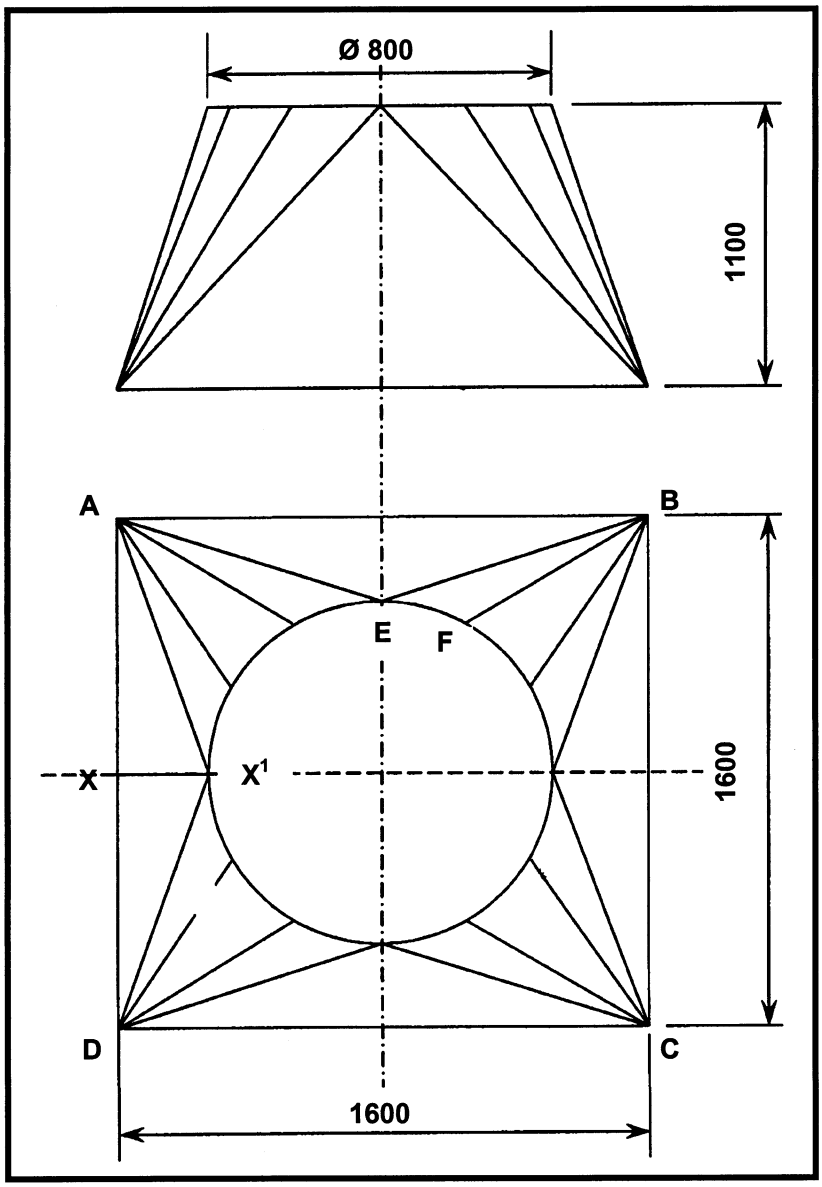
Figuur 4

QUESTION 5

5.1 **Figure 4** shows a square to round development. The measurement of the square base is 1600 mm x 1600 mm and the diameter at the top is 800 mm. The height of the development is 1100 mm.

Calculate:

5.1.1 The true length of the plate XX^1 (9)
5.1.2 The true length of BE^1 (10)
5.1.3 The true length of BF^1 (21)

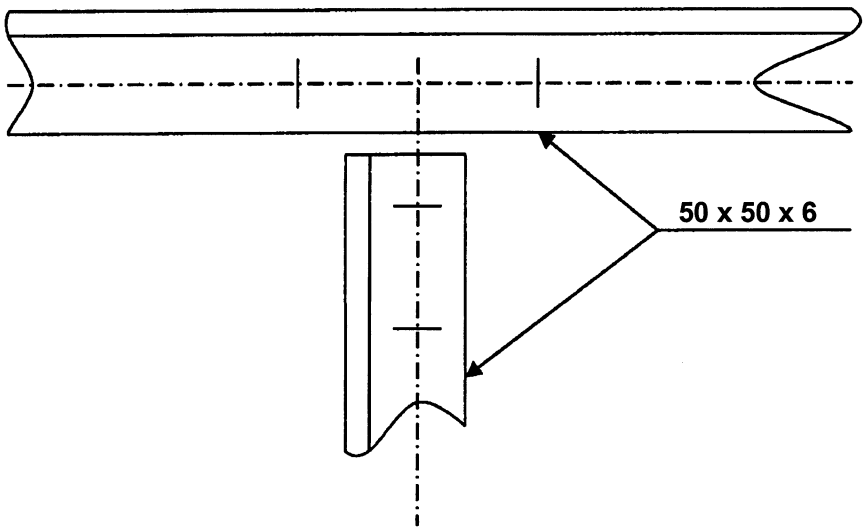


[40]

Figure 4

VRAAG 6

6.1 **Figuur 5** toon 'n eenvoudige las van 'n geklinkte tralielêer. Lê die verbinding uit volgens 'n skaal van 1 : 1 en teken die knoopplaat. Toon slegs die posisie van die klinknaels aan. Die steek vir die verbindstuk en bindbalk is 4d. Die maatrand is 1½d. Die diameter vir die klinknaels is 12 mm. Die kontramerke is 28 mm. (13)



Figuur 5

6.2 Noem DRIE redes waarom maatvorms gebruik word. (3)

6.3 Noem VYF besonderhede wat op 'n maatvorm moet verskyn. (5)

6.4 Noem VYF materiale wat gebruik word om maatvorms te vervaardig. (5)

6.5 Noem AGT gereedskapstukke wat gebruik word gedurende die maak van maatvorms. (8)

6.6 Noem DRIE vereistes vir 'n maatvormsolder. (3)

6.7 Noem DRIE voordele van gekroonde profiele. (3)
[40]

TOTAAL: 200

EINDE

QUESTION 6

6.1 **Figure 5** shows a simple joint of a riveted lattice girder. Use a scale of 1 : 1 to lay out the joint and draw the gusset plate. Show only the position of the rivets. The pitch used for the bracings and tie-beam is 4d. The landing is 1½d. The diameter of the rivets is 12 mm. The back marks are 28 mm. (13)

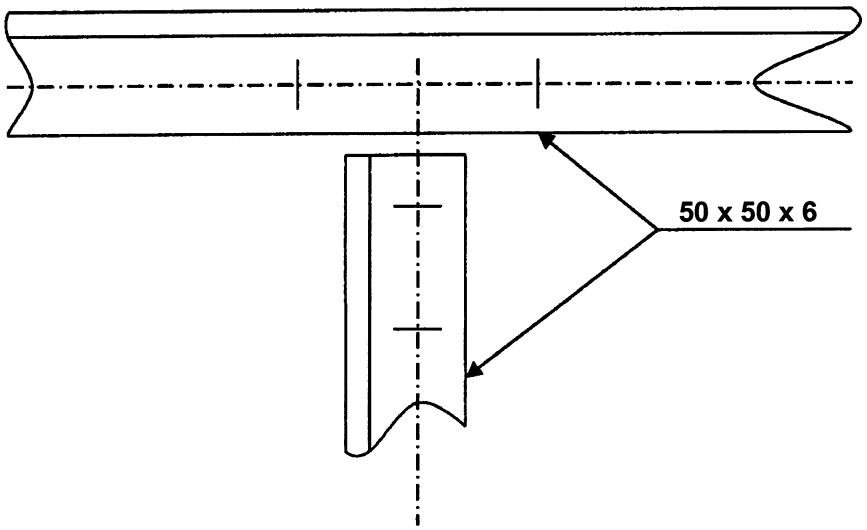


Figure 5

6.2 State THREE reasons why templates are used. (3)

6.3 Name FIVE details that must appear on a template. (5)

6.4 Name FIVE materials used for template making. (5)

6.5 Name EIGHT tools used for template making. (8)

6.6 Name THREE requirements for a template loft. (3)

6.7 State THREE advantages of castellated beams. (3)
[40]

TOTAL: 200

END