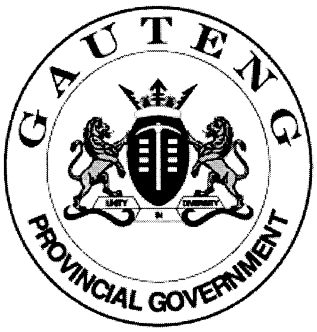
SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN



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WELDING AND METALWORKING

SWEIS EN METAAL-BEWERKING

SG 716-2/0

WELDING & METALWORKING SG

716 2 0 SG

10 pages
10 bladsye

X05

GAUTENGSE DEPARTEMENT VAN ONDERWYS

SENIORSERTIFIKAAT-EKSAMEN

SWEIS- EN METAALBEWERKING SG

TYD: 3 uur

PUNTE: 200

BENODIGHEDE:

- Antwoordboek
- Tekene antwoordboek
- 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 stellings hieronder WAAR of ONWAAR is. Skryf slegs die vraagnommer en daarnaas of die stelling WAAR of ONWAAR is in jou antwoordboek.

1.1.1 Hoëfrekwensie klankgolwe word in ultrasoniese toetsing gebruik.

1.1.2 Beskadigde stroppe moet vernietig word.

1.1.3 Vyle word van hoëkoolstofstaal vervaardig.

1.1.4 Chroom verhoog skok- en korrosieweerstand.

1.1.5 Dopverharding word op hoëkoolstofstaal toegepas.

1.1.6 'n Veiligheidsfaktor van twee moet gehandhaaf word as lere en steierrame gebruik word.

1.1.7 Die kerfbuigtoets is bekend as 'n nie-vernietigingstoets.

1.1.8 Insnyding ontstaan wanneer die stroom te laag gestel word op 'n boogsweismasjien.

1.1.9 Stale werkverhard wanneer hulle koudbewerk word.

GAUTENG DEPARTMENT OF EDUCATION
SENIOR CERTIFICATE EXAMINATION

WELDING AND METALWORKING SG

TIME: 3 hours

MARKS: 200

REQUIREMENTS:

- Answer book
- Drawing answer book
- Drawing instruments and pocket calculator

INSTRUCTIONS:

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

QUESTION 1
COMPULSORY

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

1.1.1 High-frequency sound waves are used during ultrasonic testing.

1.1.2 Damaged slings should be destroyed.

1.1.3 Files are manufactured from high-carbon steel.

1.1.4 Chromium increases shock and corrosion resistance.

1.1.5 Case-hardening is applied to high-carbon steels.

1.1.6 A safety factor of two must be obtained when using ladders and scaffolding.

1.1.7 The nick-break test is known as a non-destructive test.

1.1.8 An undercutting occurs when the current is set too low on an arc-welding machine.

1.1.9 Steels work harden when they are cold worked.

1.1.10 Maatvorms word gebruik om geld en tyd te bespaar en om vermorsing van materiaal te voorkom.

1.1.11 Elektrodes sweis makliker as hulle klam gehou word.

1.1.12 Die veiligheidsfaktor is die hoeveelheid keer waarmee die maksimum spanning verhoog word om 'n veilige spanning te verkry.

1.1.13 Goeie beligting en ventilasie dra by tot swak huishouding.

1.1.14 Stroppe moet gebruik word wanneer materiaal met skerp hoeke gehys (gelig) word.

1.1.15 Meervoudige lopieneersmelting verhoog hardheid. (15)

1.1.10 Templates are used to save money, time and avoid wastage of material.

1.1.11 Electrodes weld more easily when they are kept damp.

1.1.12 The factor of safety is the number of times with which the maximum stress is increased to obtain a safe stress.

1.1.13 Good lighting and ventilation contributes to bad housekeeping.

1.1.14 Slings should be used when lifting material with sharp corners.

1.1.15 Multiple run deposits increases hardness. (15)

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

VOORBEELD 1.2.21 – U

	KOLOM A		KOLOM B
1.2.1	Verhitte staal wat in water, olie of pekel gedompel word, vorm deel van die	A.	'n hoëkoolstofinhoud het
1.2.2	Blaasgate word gevorm wanneer dit	B	3-5d
1.2.3	Die belangrikste legeringselement in staal is	C.	x-straal, kleurstofdeurdringing en die ultrasoniese toetse
1.2.4	Taaiheid is die vermoë van 'n metaal om	D.	werk kromtrekking van onderdele wat gesweis moet word, tee
1.2.5	Langwerpige en vervormde korrelstruktuur kom voor gedurende die	E.	pylpunt, verwysingslyn, stert en spesifikasies
1.2.6	Kniplemme, houtbeitels en koue beitels word vervaardig met staal wat	F.	'n taaier metaal te verkry deur sy brosheid te verminder
1.2.7	Inspeksie van sweislaste sluit in die	G.	sagtheid te verwek, masjienbaarheid te verbeter, spanning te verminder en rekbaarheid te verbeter
1.2.8	Vooraf klamping word gebruik om	H.	steierrame
1.2.9	Steke wat gebruik word op maatvorms is tussen	I.	verhardingsproses
1.2.10	Elemente van 'n sweissimbool is	J.	'n té kort boog gebruik word en afkoeling te vinnig geskied
1.2.11	Eienskap van 'n krag	K.	perliet, ferriet en austeniet
1.2.12	Kantelbalk	L.	tipe elektrode wat gebruik word asook die gebruik van die regte stroom, booglengte, spoed en sweishoek
1.2.13	Is deel van die mikrostruktuur	M.	suurstof wat opgeneem word in die sweislas
1.2.14	Brosheid word veroorsaak deur	N.	kraking van die moedermetaal
1.2.15	Tempering word gebruik om	O.	skoklasse te weerstaan
1.2.16	Uitgloeiing word uitgevoer om	P	720°C
1.2.17	Veiligheidsfaktor van ses word hier gebruik	Q.	koue bewerkingsproses
1.2.18	'n Algemene probleem gedurende die verhardingsproses is	R.	een ent is vas terwyl die ander ent vry is om te beweeg
1.2.19	Die kwaliteit van 'n sweislas hang af van die	S.	grootte en rigting
1.2.20	ACI	T.	koolstof

(20)

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

EXAMPLE 1.2.21 – U

	COLUMN A		COLUMN B
1.2.1	Heated steels that are quenched in water, oil or brine form part of the	A.	a high carbon content
1.2.2	Blowholes are formed when	B	3-5d
1.2.3	The most important alloying element in steel is	C.	x-ray, dye-penetrant and ultrasonic tests
1.2.4	Toughness is the ability of metal to	D.	counter distortion in the parts to be welded
1.2.5	Elongated and distorted grain structures occur during the	E.	arrow, reference line, tail and specifications
1.2.6	Shear blades, wood chisels and cold punches are manufactured from steel containing	F.	obtain a tougher material by decreasing its brittleness
1.2.7	Inspection of welds include	G.	induce softness, improve machinability, remove stresses and improve ductility
1.2.8	Pre-setting is used to	H.	scaffold
1.2.9	Pitches used on templates are between	I.	hardening process
1.2.10	Are elements of a welding symbol	J.	using a too short arc and too rapid cooling takes place
1.2.11	Characteristics of a force	K.	perlite, ferrite and austinite
1.2.12	Cantilever	L.	type of electrode used, the correct use of current setting, arc length, speed of travel and weld angle
1.2.13	These are part of a microstructure	M.	oxygen is absorbed in the weld
1.2.14	Porosity is caused when	N.	cracking of the parent metal
1.2.15	Tempering is used to	O.	withstand shock loads
1.2.16	Annealing is carried out to	P	720°C
1.2.17	Safety factor of six is used on	Q.	cold-working process
1.2.18	Common problem during the hardening process is the	R.	one end is fixed while the other is free to move
1.2.19	Quality of a weld depends on the	S.	magnitude and direction
1.2.20	ACI	T.	carbon

(20)

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

1.3.1 Met verwysing na die yster-koolstofdiagram bevat koolstofstaal wat bokant die boonste kritiese temperatuur verhit word, hoofsaaklik _____.

A. ferriet en perliet
B. sementiet en austeniet
C. slegs austeniet
D. perliet

1.3.2 Boogsweis met 'n té lae stroom, veroorsaak _____.

A. oormaat spatsels
B swak penetrasie
C. aansienlike distorsie
D. inkarteling

1.3.3 Laekoolstofstaal kan nie op die konvensionele manier verhard word nie, omdat _____.

A. dit te sag is
B. dit te rekbaar en smeebaar is
C. die koolstofinhoud te laag is
D. die koolstofinhoud te hoog is

1.3.4 Wanneer 'n slypmasjien gebruik word, maak seker dat _____.

A. die masjien op die regte revolusies gestel is
B. die russtand op 3 mm gestel is
C. jy altyd handskoene dra
D. die metaal wat geslyp gaan word, geen roes bevat nie

1.3.5 Goeie huishouding beteken _____.

A. dat jou huis in orde moet wees
B. dat daar goeie beligting en ventilasie is
C. die vloere gepoleer en skoon moet wees
D. 'n plek vir alles en alles op sy plek ten alle tye (5)

[40]

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

1.3.1 With reference to the iron-carbon equilibrium diagram, carbon steel that is heated above the upper critical temperature mainly contains _____.

A. ferrite and perlite
B. cementite and austinite
C. complete austinite
D. perlite

1.3.2 Arc welding with the current too low, results in _____.

A. excessive spatter
B poor penetration
C. considerable distortion
D. an undercut

1.3.3 Mild-carbon steel cannot be hardened in the conventional way, because _____.

A. it is too soft
B. it is too ductile and malleable
C. the carbon content is too low
D. the carbon content is too high

1.3.4 When using a grinding machine, make sure that _____.

A. the machine is set to the required revolutions
B. the rest position is set to 3 mm
C. you always wear gloves
D. the metal to be grinded is rust free

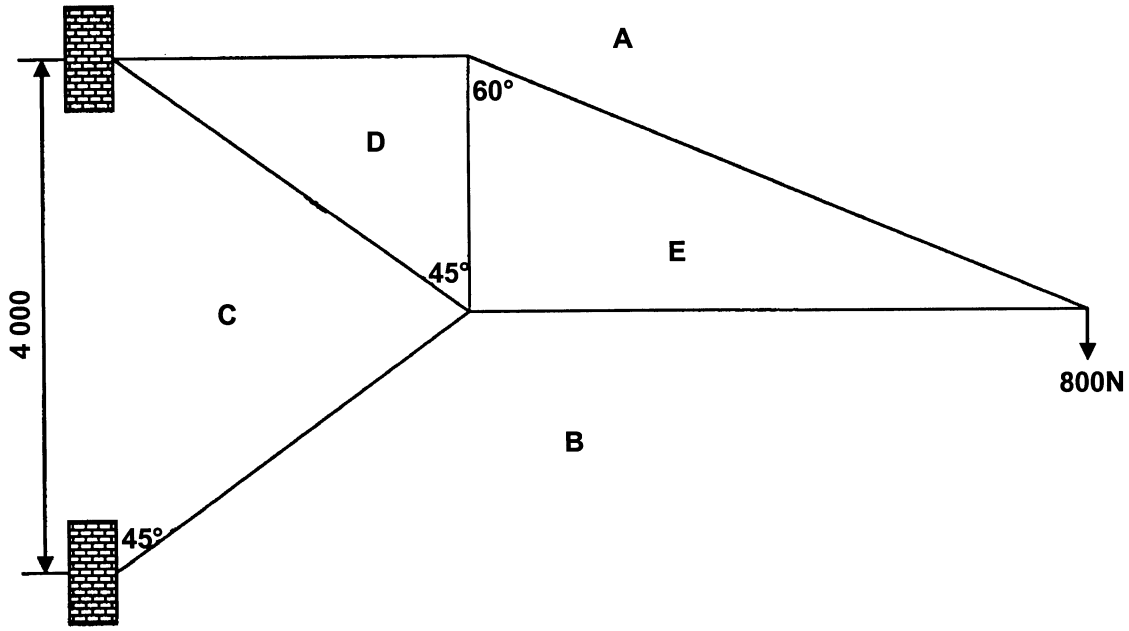
1.3.5 Good housekeeping means _____.

A. your house must be in order
B. good lighting and ventilation
C. the floor must be polished and kept clean
D. a place for everything and everything in its place at all times (5)

[40]

VRAAG 2

2.1 **Figuur 1** toon 'n kantelbalk wat aan 'n 800 N krag aan die vry ent onderwerp word. Die twee steunpunte is 4 meter uitmekaar.



Figuur 1

2.1.1 Teken die kragtediagram volgens 'n **skaal 10 mm = 100 N**. (8)

2.1.2 Dra die tabel oor in jou antwoordboek en voltooi dit deur die kragtediagram te gebruik om die grootte en aard van die kragte in elke onderdeel van die raamwerk te bepaal.

		KRAGTE - N	
RAAMDEEL	**AFMETING**	**STANG**	**STUT**
BC			
CD			
DE			
EB			
AD			
AE			

(12)

2.1.3 Teken die ruimtediagram volgens 'n skaal van 1:50 en dui die aard van die kragte aan op die ruimtediagram. (6)

QUESTION 2

2.1 **Figure 1** represents a cantilever which is subjected to a 800 N force at the free end. The two supports are 4 metres apart.

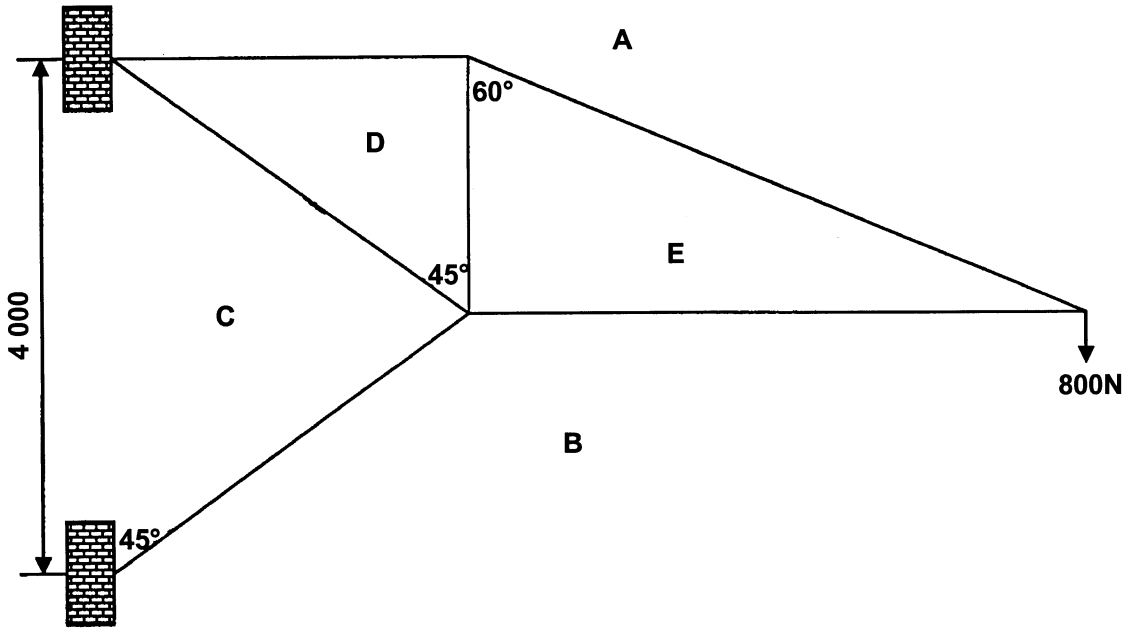


Figure 1

2.1.1 Draw the forces diagram by using a scale of **10 mm = 100 N**. (8)

2.1.2 Copy the following diagram in your answer book and complete it by using the force diagram to determine the magnitude and nature of the forces in each member of the framework.

		FORCE - N	
MEMBER	**MEASUREMENT**	**TIE**	**STRUT**
BC			
CD			
DE			
EB			
AD			
AE			

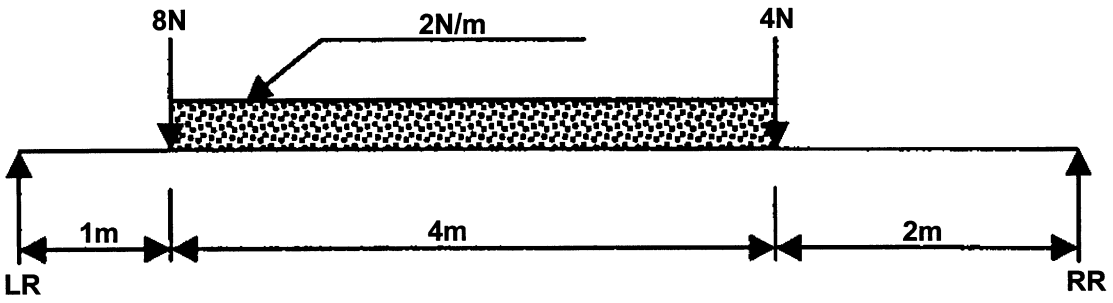
(12)

2.1.3 Draw the space diagram to a scale of 1 : 50 and indicate the nature of the forces on your space diagram. (6)

2.2 Die eenvoudig ondersteunde balk in **Figuur 2** dra 'n verspreide las van 2 N/m oor die 4-metergedeelte van die balk. Die totale lengte van die balk is 7 meter.

Toon die volgende berekeninge:

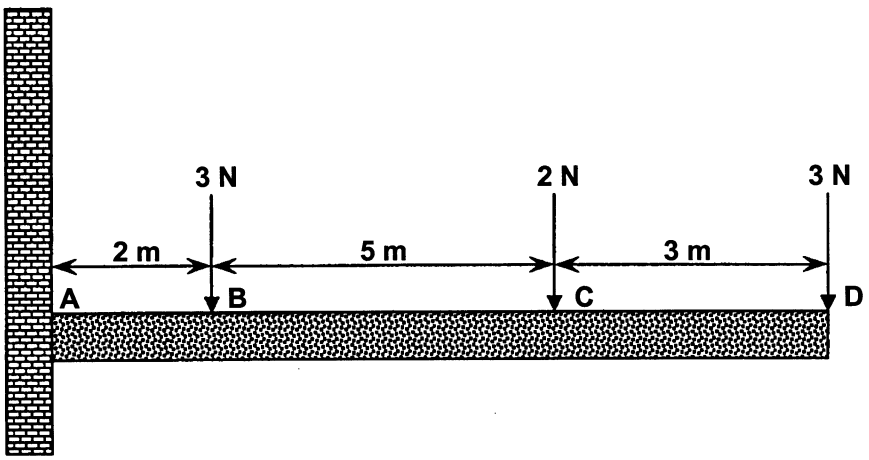
2.2.1 Verander die verspreide las na 'n puntbelasting. (2)
2.2.2 Bereken die linker- en regterreaksies van die balk. (12)



Figuur 2 **[40]**

VRAAG 3

Figuur 3 toon 'n kantelbalk met drie puntbelastings. Die kantelbalk is 10 meter lank.



Figuur 3

3.1 Teken die ruimtediagram volgens 'n skaal van 1 cm : 1 m. (2)
3.2 Bereken die buigmomente by punte **A**, **B**, **C** en **D**. (8)
3.3 Bereken die skuifkragte by punte **A**, **B**, **C** en **D**. (8)
3.4 Teken die buigmomentdiagram volgens skaal van 10 mm : 5 Nm. (11)
3.5 Teken die skuifkragdiagram volgens skaal van 1 cm : 1 N. (11)
[40]

2.2 The simple supported beam in **Figure 2** carries a distributed load of 2 N/m over the 4 metre section of the beam. The total length of the beam is 7 metres.

Show the following calculations:

2.2.1 Convert the distributed load to a point load. (2)
2.2.2 Calculate the left and right reactions of the beam. (12)

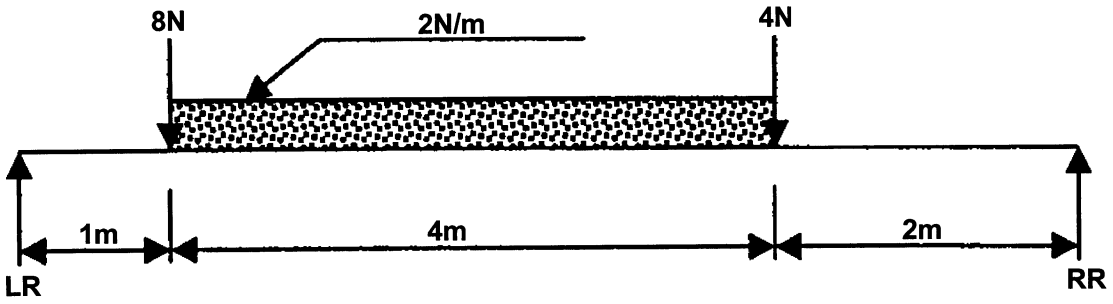


Figure 2 **[40]**

QUESTION 3

Figure 3 shows a cantilever with three point loads. The cantilever is 10 metres long.

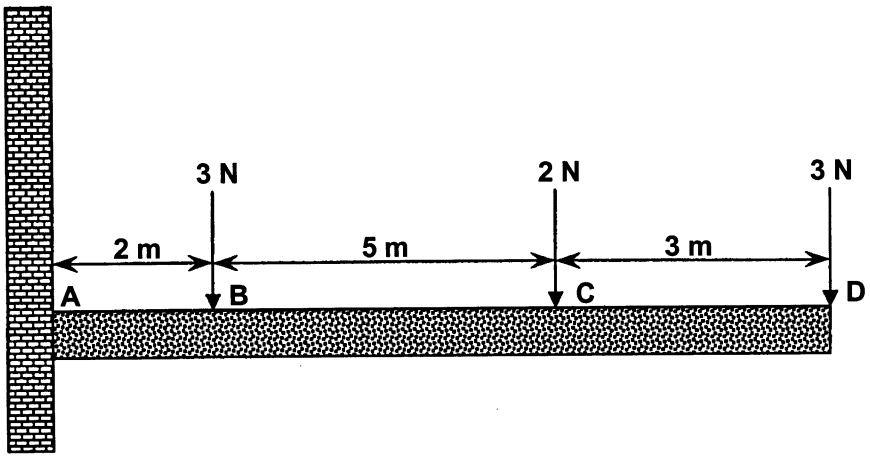


Figure 3

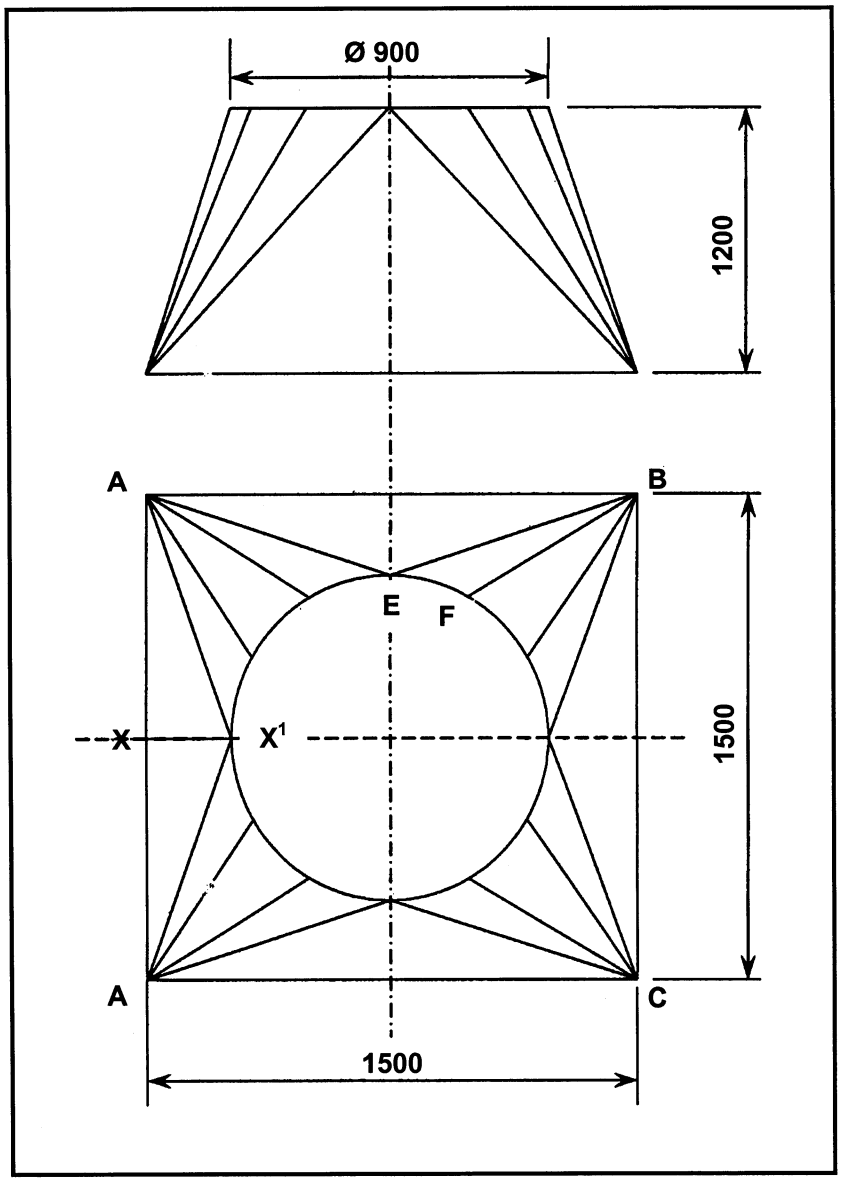
3.1 Draw the space diagram to a scale of 1 cm : 1 m. (2)
3.2 Calculate the bending moment of points **A**, **B**, **C** and **D**. (8)
3.3 Calculate the shear forces at points **A**, **B**, **C** and **D**. (8)
3.4 Draw the bending moment diagram to a scale of 10 mm : 5 Nm. (11)
3.5 Draw the shear force diagram to a scale of 1 cm : 1 N. (11)
[40]

VRAAG 4

Figuur 4 toon 'n vierkantige na ronde ontwikkeling. Die afmeting van die vierkantbasis is 1 500 mm x 1 500 mm en die diameter aan die bokant is 900 mm. Die hoogte van die ontwikkeling is 1 200 mm.

Bereken:

4.1 Die ware lengte van die plaat by XX^1 (9)
4.2 Die ware lengte van BE^1 (10)
4.3 Die ware lengte van BF^1 (21)



Figuur 4 **[40]**

QUESTION 4

Figure 4 shows a square to round development. The measurement of the square base is 1500 mm x 1500 mm and the diameter at the top is 900 mm.
The height of the development is 1200 mm.

Calculate:

4.1 The true length of the plate XX^1 (9)
4.2 The true length of BE^1 (10)
4.3 The true length of BF^1 (21)

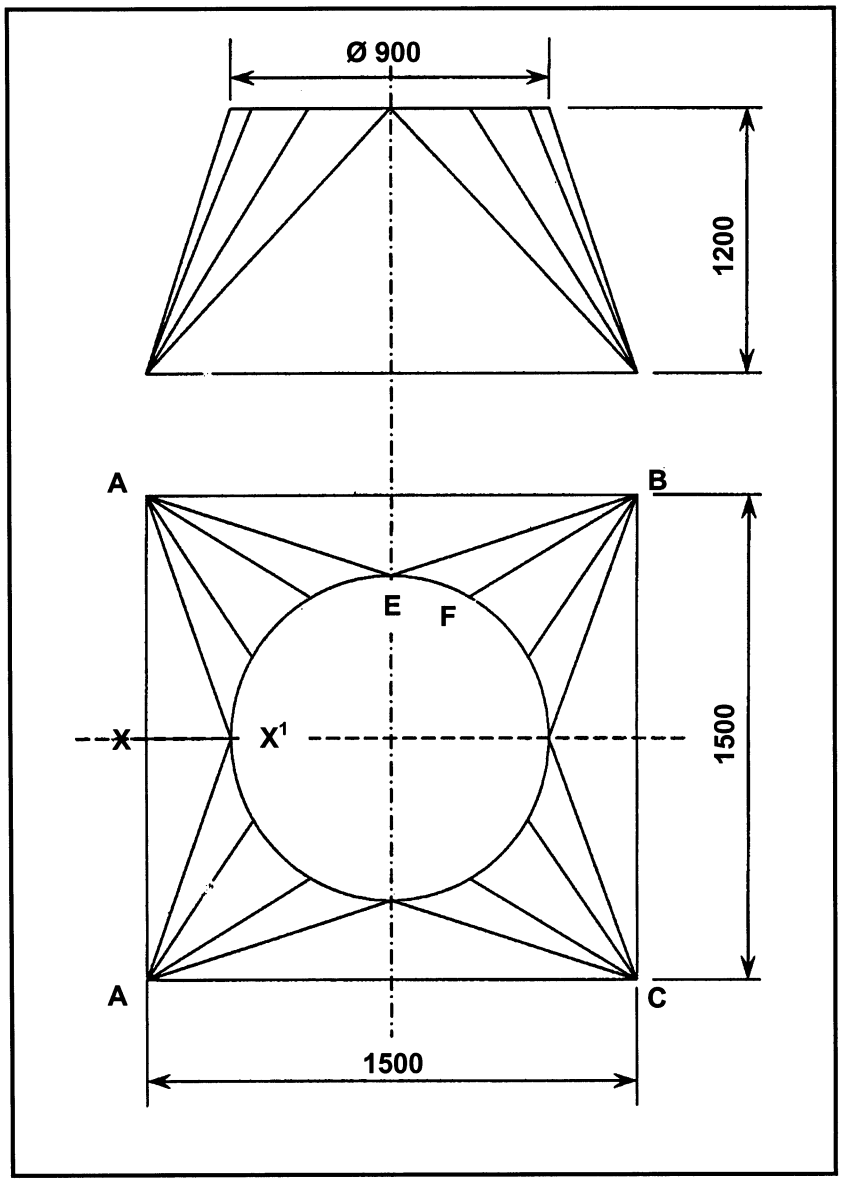


Figure 4

[40]

VRAAG 5

5.1 'n Staalstaaf met 'n 300 mm lengte, met 'n diameter van 30 mm word aan 'n trektoets onderwerp. Die gemete krag om die toets te voltooi was 120 kN. Die finale lengte van die toetsstuk was 312 mm.

5.1.1 Skakel 30 mm om na meter. (2)
5.1.2 Bewys deur berekeninge dat die area van die staalstaaf 706,85 x 10^{-6} m^2 is. (4)
5.1.3 Bereken die spanning in die staalstaaf gedurende die toets. (6)
5.1.4 Bereken die vormverandering. (5)
5.1.5 Bereken Young se Modulus (E). (5)

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

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

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

5.2 'n 50 kilogram weekstaalplaat teen R8,00 per kilogram en 'n hoekyster van 72 meter met 'n massa van 10 kilogram per meter teen R2,50 per kilogram word gebruik vir die vervaardiging van 'n dakspar. Die totale aangetekende tyd om die taak te voltooi was 40 uur teen 'n tarief van R30,00 per uur. Drakoste van 110% van die arbeidskoste kan gehef word.

Bereken:

5.2.1 Die materiaalkoste (8)
5.2.2 Die arbeidkoste (3)
5.2.3 Die drakoste (3)
5.2.4 Die totale koste (4)
[40]

QUESTION 5

5.1 A steel bar 300 mm in length, with a diameter of 30 mm is subjected to a tensile test. The force recorded to complete the test was 120 kN. The final length of the test piece was 312 mm.

5.1.1 Convert 30 mm to metres. (2)
5.1.2 Proof by calculations that the area of the steel bar is 706,85 x 10^{-6} m^2. (4)
5.1.3 Calculate the stress in the steel bar during the test. (6)
5.1.4 Calculate the strain. (5)
5.1.5 Calculate Young's Modulus (E) (5)

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

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

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

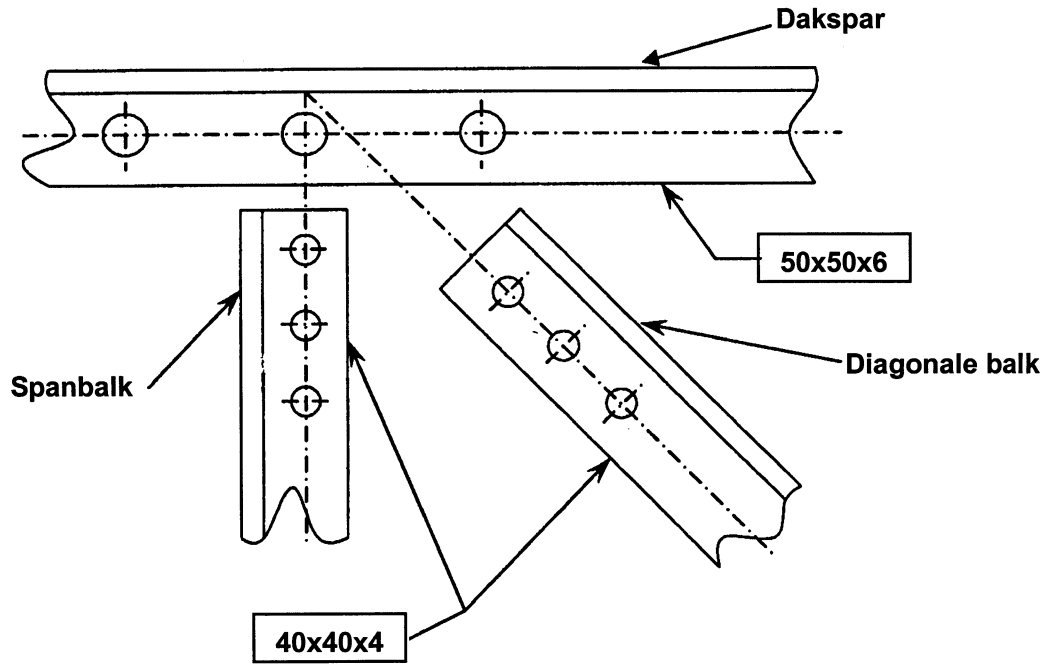
5.2 A 50 kilogram mild-steel plate at R8,00 per kilogram and a 72 metre angle-iron with a mass of 10 kilogram per metre at R2,50 per kilogram is used for the manufacturing of a roof truss. The total time booked to complete the task is 40 hours at a tariff of R30,00 per hour. Overhead costs of 110% of the labour cost can be charged.

Calculate:

5.2.1 The material cost (8)
5.2.2 The labour cost (3)
5.2.3 The overhead cost (3)
5.2.4 The total cost (4)
[40]

VRAAG 6

6.1 Ontwerp 'n maatvorm vir die gegewe skets van 'n gedeelte van 'n tralielêer. Die dakspar bestaan uit 50 x 50 x 6 hoekyster terwyl die spanbalk en die diagonale bint van 40 x 40 x 4 hoekyster gemaak is. Die knoopplaat word aan die dakspar geheg met 20 mm klinknaels terwyl 16 mm klinknaels vir die spanbalk en diagonale balk gebruik word. Die terugsetting (kontramerk) wat vir die dakspar gebruik is, is 28 mm en 22 mm vir die spanbalk en diagonale balk. Die steek wat gebruik is vir die dakspar is 5d en 3d vir die span en diagonale balk. Die grade tussen die spanbalk en diagonale balk is 45°.
Gebruik 'n **skaal van 1 : 2** vir die ontwerp (Die standaard naatrand is 1,5d). (20)



6.2 Noem VIER voordele van die gebruik van maatvorms. (4)

6.3 Noem DRIE eienskappe van 'n maatvormsolder. (3)

6.4 Noem VIER besonderhede wat op 'n maatvorm verskyn. (4)

6.5 Noem VIER materiale wat vir maatvormvervaardiging gebruik word. (4)

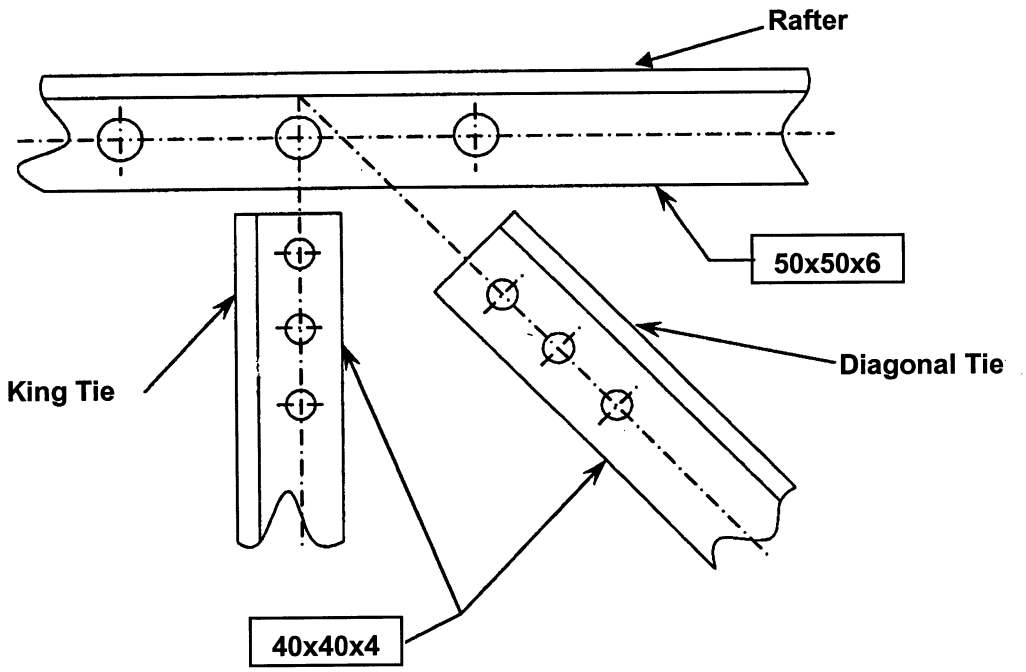
6.6 Noem VYF gereedskapstukke wat gebruik word in die maatvormsolder. (5)
[40]

TOTAAL: 200

EINDE

QUESTION 6

6.1 Design a gusset plate for the given section of a lattice girder. The rafter is made of 50 x 50 x 6 angle-iron whilst the king-tie and diagonal-tie are made of 40 x 40 x 4 angle-iron. The gusset plate is fastened to the rafter with 20 mm rivets while 16 mm rivets are used for the king and diagonal-ties. The back-mark used on the rafter is 28 mm and 22 mm for the king-tie and diagonal-tie. The pitch used for the rafter is 5d and 3d for the king and diagonal-tie. The angle between the king-tie and diagonal tie is 45°.
Use a **scale of 1 : 2** for the design. (The landing is 1,5d.) (20)



6.2 Name FOUR advantages for the use of templates. (4)

6.3 Name THREE characteristics of a template loft. (3)

6.4 Name FOUR pieces of information that appear on templates. (4)

6.5 Name FOUR materials used for template making. (4)

6.6 Name FIVE tools used in the template loft. (5)
[40]

TOTAL: 200

END